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RITISH RED CROSS SOCIETY

FIRST AID MANUAL

No. 1

BY

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K.C.B., K.B.E., F.R.C.P.

AND

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Page 7, paragraph 9, at end of line 3, after ' vomiting ', insert ' except in the case of corrosive poisoning.'

Page 7, paragraph 12, line 4, after ' *Administration* ', insert ' *and Training* '.

Page 9, Figure 3, add to legend
' A — Red blood corpuscles
B — White blood corpuscle (leucocyte type)
C — White blood corpuscle (lymphocyte type).'

Page 10, line 4, after ' body ' insert ', except the pulmonary artery which conveys de-oxygenated blood to the lungs (see pulmonary system on page 14).'

Page 48, line 11, for ' malaena ', substitute ' melaena '.

Page 55, last word, for ' malaena ', substitute ' melaena '.

Page 62, last word, and first two lines of page 63, delete ' Unless the drowning is due to a person having fallen unconscious into a shallow puddle of water '.

Page 67, Schafer's method (i), line 2, delete ' stretched up beyond the head ', substitute ' placed at either side of head as in Fig. 35.'

Page 75, delete paragraph 7, substitute

'7. **Potassium permanganate** is used for washing out the stomach in cases of poisoning by phosphorus or by narcotics, such as opium and morphine. The dosage used in first aid is a few crystals to a tumblerful of water, that is, sufficient to make the water a deep pink. A stronger solution (a salt-spoonful of crystals to a pint of water) may be used to bathe a snake- or a dog-bite.'

Page 75, paragraph 10, last line, for 'boiling water', read 'boiled water'.

Page 101, paragraph 12, after 'straight', add 'or slightly bent'.

Page 123, paragraph (iv), delete the first two lines, substitute '**Wash your hands thoroughly**, if time and facilities exist; alternatively, smear a bland and non-greasy antiseptic cream over the hands. It is better, however, to risk contaminating a wound'.

Page 139, line 7, '(baking powder)' should read '(baking soda)'.

Pages 143 and 144, delete paragraph (iii) regarding gas-warfare burns, substitute

'(iii) **Gas-warfare burns** may result from contact with liquid blister gas (*e.g.* **mustard gas**) or from prolonged exposure to the vapour. Most blister gases have a characteristic smell, but this cannot be used as a method of recognising them during air raids, as in future wars it may be necessary to wear respirators whenever bombs are falling, since the rapid action of the nerve gases, which might be used, are capable of causing injury before their presence can be recognised.

'Exposure to blister gas vapour or contact with the liquid may not cause immediate irritation.

If a respirator is not worn, the vapour will affect the eyes and breathing passages, and, if the exposure is sufficiently prolonged, will cause redness and blistering of the skin. Contact with the liquid will cause blistering of the skin, if immediate measures are not taken to remove or neutralize the contamination.

'When liquid nerve gas comes into contact with the skin, it is absorbed and causes harmful effects on the system without any burning or blistering of the skin.

'**Immediate action is necessary if the skin is seen to be contaminated with any liquid gas.**

'**First aid treatment:**

(*a*) **If the eyes are affected, flush them immediately with water.** If only one eye is involved, be careful not to let the wash water run into the other eye.

(*b*) **Remove grossly contaminated clothing.**

(*c*) **Dab off any oily fluid** on the surface of the skin, preferably with a clean damp cloth or swab.

(*d*) **Scrub the affected area thoroughly with soap and water, or apply aqueous bleach cream.** The cream should be washed off after two minutes to prevent skin irritation.

(*e*) If the contamination is **known to be mustard gas**, apply anti-gas ointment (if available) directly to the contamination on the skin and rub it in until it disappears.

(*f*) If a burn subsequently develops, **treat** the case **as an ordinary burn**.

(*g*) **Never open a gas blister.**'

Page 166, Fig. 124, add directly above the legend under first illustration — 'Collar bone'

second illustration — ' Upper arm '
third illustration — ' Lower arm.'

Page 175, paragraph 4 (i) (*d*), first word in second line, delete ' **small** ', substitute ' **large** '.

Page 175, paragraph 4 (i), add a new clause (*e*).

' (*e*) **Feel for the pulse** at each wrist, to ensure that the pads in the armpits are not interfering with the blood flow in the axillary arteries.'

Page 180, top of page, after line 3, insert new clause (*h*).

' (*h*) **Fix the injured arm to the side of the body** by means of a broad-fold bandage.'

Page 182, (ii) Treatment (*c*), first line, delete ' shorter ', substitute ' longer '. Third line, delete ' longer ', substitute ' shorter '.

Page 194, second line, for ' Fig. 142 ', read ' Fig. 143 '.

Page 240, paragraph 3 (iv), fifth line, ' (baking powder) ' should read ' (baking soda) '.

Page 252, under heading Chloral, Dial, etc., in the third column of the Table, delete ' Give a teaspoonful of permanganate of potash crystals in a cup of water ', substitute ' Give a few crystals of potassium permanganate dissolved in a tumblerful of water '.

Page 253, under the two headings, Opium and Phosphorus, in the third column of Table, delete ' Give a teaspoonful of permanganate of potash crystals in a cup of water ', substitute ' Give a few crystals of potassium permanganate dissolved in a tumblerful of water.'

Page 262, after line 7, add ' R **Radio-active** Contamination.'

Page 257, add new paragraph at the bottom.

'10. **Heart attacks** are usually due to one of three conditions — angina pectoris, coronary occlusion, or congestive failure.

'(i) **Angina pectoris** occurs chiefly in men after middle life, especially those who have had to shoulder the burden of heavy mental strain for a number of years. The arteries supplying blood to the heart muscle are thickened and the heart's action is impeded by want of nourishment.

(*a*) The onset of an attack is sudden during exercise or emotion, particularly after a heavy meal.

(*b*) The face is ashen and the patient often shows fear of death.

(*c*) There is pain over the heart and maybe down the left arm.

(*d*) The breath is held.

(*e*) The attack usually lasts only a few minutes, but recurrences may be numerous.

(*f*) **Amyl nitrite inhalation helps to give relief.** Angina sufferers frequently carry amyl nitrite capsules with them. If so, break a capsule between the folds of a handkerchief and hold it under the patient's nose.

'(ii) **Coronary occlusion** is commoner in men than in women and may occur even in the young, often in those between 30 and 50 years of age. Here the arteries of the heart are diseased and become blocked by the clotting of blood inside them. Sudden blockage of one of the main arteries of the heart usually causes death.

(*a*) The onset of an attack is sudden, usually while at rest in bed or while sitting quietly after a meal.

(*b*) The patient collapses, the face is pale, the brow is covered with beads of sweat, and the pulse is small and rapid.

(*c*) Pain over the heart or in the pit of the stomach may be excruciating.

(*d*) The bowels or bladder may evacuate or vomiting may occur.

(*e*) The attack may last for hours or days; recurrences are likely to end fatally.

(*f*) Amyl nitrite is apt to do harm. **Morphine is often required to ease the pain**; this drug can only be given by the doctor.

(iii) **Congestive failure** occurs in those who have chronic heart disease affecting either the valves or the muscle of the heart. The organ fails to pump efficiently owing to the blood leaking back through the damaged or stretched valves. There is, therefore, back pressure and congestion in the venous system generally and in the blood-vessels of the lungs, thus interfering with oxygenation of the blood. This leads to breathlessness and bluish colouration of the skin. The sufferer may collapse suddenly with vomiting or spitting of blood, accompanied by all the symptoms and signs of shock (see page 16). Such occurrences usually take place in the home, not in the street.

(iv) **First Aid Treatment:**

It is difficult, if not impossible, for the first aider to diagnose whether a person who becomes faint or unconscious is suffering from a heart attack or some other condition, unless the patient has a history of heart disease, in which case first aid should be given, as follows:

(*a*) **Do not move** the patient unless it is absolutely necessary.

(*b*) **Place the patient in a sitting position**, as a failing heart works more economically this way than when a person is lying down.

(*c*) **Undo tight clothing around the neck and waist** to lessen any impediment to the circulation.

(*d*) **Prevent the patient falling forward** and asphyxiating himself.

(*e*) Be ready to deal with any **vomiting or movement of the bowels or bladder**.

(*f*) **Keep patient warm** as for shock (see page 19).

(*g*) **Give amyl nitrite inhalation** if the patient is an angina sufferer and has a capsule on him.

(*h*) **Send for a doctor at once.**'

Page 261, line 11, after '*Administration*', insert '*and Training*'.

H. E. W.
S. C.

PREFACE

It is ten years since the last edition of the *British Red Cross Society's First Aid Manual No. 1* was produced. In view of this, and the changes and advances in medicine, it was necessary to rewrite most of the book to bring it up to date.

The subjects dealt with have been arranged, as far as practicable, in their order of importance as life-saving measures and the frequency with which they are encountered by the first-aider. The prime importance of the immediate need to adopt anti-shock measures with the minimum of handling of the patient is stressed throughout. Fractures have been removed from their time-honoured place in the early chapters, as it is considered desirable that the first-aider should learn about those conditions which he can be expected to become proficient at treating, before studying the more complicated technique of immobilising fractures. New chapters on miscellaneous emergencies, action at the incident, and first aid in Civil Defence have been added.

To help the first-aider to appreciate the reasons for the various treatments advocated, a brief reference to the structure and functions of the different systems and organs has been given where appropriate.

The illustrations have been taken mainly from the previous edition written by Brigadier St. J. D. Buxton, but a number of new ones have been introduced by the authors, who desire to express their grateful acknowledgments to the Controller of His Majesty's Stationery Office for permission to reproduce illustrations from the *R.A.M.C. Training Pamphlet No. 3*, 1944, and *R.A.F. Principles of Anatomy and Physiology for Physical Training Instructors*, 1946 (A.P. 3125), and to the following firms for their courteous

permission to reproduce illustrations from the Manuals mentioned : Messrs. Baillière, Tindall & Cox, *B.R.C.S. Elementary Anatomy and Physiology*; Messrs. Cassell & Co., Ltd., *B.R.C.S. First Aid and Nursing Manuals*; Educational Productions Ltd., *B.R.C.S. Junior First Aid Manual*; The Oxford University Press, *B.R.C.S. Notebook of First Aid* (Second Edition); Messrs. John Wright & Sons, *First Aid to the Injured and Sick*; and Messrs. Faber & Faber, Ltd., *A New System of First Aid*, by Dr. R. C. C. Clay.

We are indebted to the Home Office for permission to use material from *A.R.P. Handbook No. 10* which has been incorporated in Chapters XIII, XVI, and XXIV, dealing with burns, fractures, and Civil Defence First Aid, respectively.

HAROLD E. WHITTINGHAM
STANFORD CADE

LONDON
November 1948

CONTENTS

LIST OF ILLUSTRATIONS

GOLDEN RULES OF FIRST AID

1. **Do first things first**, quietly, quickly, and without fuss or panic.

2. **Do not attempt too much** — do the minimum that is essential to save life and prevent the condition worsening.

3. **Stop any bleeding.**

4. **Give artificial respiration** if breathing has stopped — every second counts.

5. **Guard against or treat for shock** by keeping the patient warm, by moving as little as possible and with every gentleness, and by relieving pain.

6. **Do not remove clothes** unnecessarily, as they help to keep the patient warm and so guard against shock.

7. **Reassure patient** and those around, and so help to avoid nervousness and panic.

8. **Do not allow people to crowd** around, as fresh air is essential.

9. **Arrange for the removal** of the case to the care of a doctor or a hospital as soon as possible, and **notify the police** in the case of a serious accident.

10. **Do not apply wet dressings** in first aid, except in the case of certain burns, as they make wounds sodden and, therefore, tend to aid the spread of infection. The doctor or trained nurse will advise on special dressings needed.

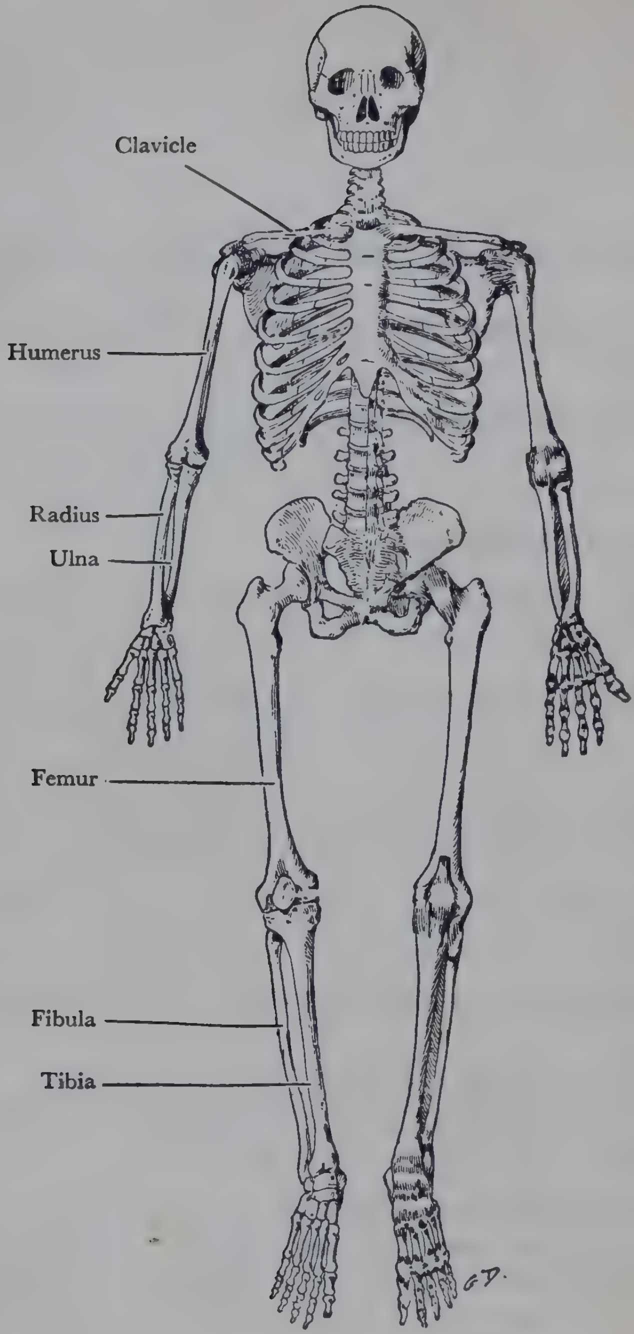


FIG. 1.—THE SKELETON
Ligaments shown on left side of the body

CHAPTER I

GENERAL PRINCIPLES OF FIRST AID

THE NEED FOR FIRST AID

First aid knowledge is always valuable, for, strange as it may seem, the incidence of wounds and other injuries (excluding death), even in the fighting Services, is as great in peacetime as in war, as battle casualties are equalised by the larger number of accidents that occur in peacetime on the road and at games. The scope for the application of first aid is indeed wide, for it includes the accidents and sudden illnesses that occur in the home, in industry, on the road, at race meetings, games, fêtes and fairs, also beach accidents, air crashes, and sea and mountain rescues. In fact, the need for first aid is so great that it would benefit all to have a good working knowledge of it. In addition, however, it is necessary to have specially trained and skilled first aid workers who can be called upon and relied on in special emergencies, and who can be posted for duty at important events to deal with possible casualties.

THE SCOPE AND AIMS OF FIRST AID

First aid in cases of sudden illness or accident should be limited to emergency assistance until a doctor's services are available. The first-aider must never attempt to usurp the duties of the doctor: he should merely apply simple and effective measures to benefit the patient until the doctor arrives or the patient is admitted to hospital. The commoner conditions which call for first aid are shock, bleeding, fits and faints, minor and major wounds and other injuries,

stings, bites, fractures, dislocations, burns, drowning, and poisoning.

The aims of the first-aider should be

(1) **to prevent immediate danger of death** from such conditions as severe bleeding or stoppage of breathing; and

(2) **to prevent the condition getting worse** by applying sterile or clean dressings to protect wounds against entrance of germs, by immobilising broken bones, and by guarding against shock by means of rest, warmth and the relief of pain.

HOW TO APPROACH THE PROBLEM OF FIRST AID

Time should not be wasted trying to make a full diagnosis; that should be left to the doctor. The main thing to determine, after laying the patient down in a comfortable position in order to avoid unnecessary strain on the heart and to help prevent or lessen shock, is whether immediate first aid is essential to arrest bleeding, re-establish or promote breathing, or counteract poisoning; if so, act at once. As soon as possible the patient should be suitably wrapped, so as to maintain the normal body temperature and thus further lessen the risk of shock. **These points must be attended to before any detailed examination of the case is made. It is better to save a life without making a complete diagnosis than to make a diagnosis and let the patient die while so doing.**

Before giving further first aid, it is advisable to determine what is the matter with the patient from the signs, symptoms, and history of the case, aided possibly by such clues as a bottle of poison or escaping gas. The examination should be done calmly, quietly, quickly, and gently with the minimum of movement of the patient and with the utmost tact and sympathy. Clothes help to keep the patient warm and so their retention plays an important part in preventing or lessening shock: as a general rule they should be left on,

ut not if soaked with petrol or strong acid or alkali; at nost they should be slit at the seams to facilitate examina-ion of a particular injury or to allow of efficient first aid.

Signs are the points about a case that may be seen, ieard, felt, or smelt by the observer. For example — leeding, congestion or pallor of the face, deformity, and wellings can be seen; grating of a broken bone or the cry of pain may be heard; swellings and gratings of broken ones can be felt; the odour of alcohol or of certain oisons or the sweet breath of a person in diabetic coma nay be smelt.

Symptoms are sensations of which only the patient is onscious; *e.g.* pain, nausea, or numbness. Symptoms nay be misleading, especially to the first-aider, as they lepend greatly on the temperament of the patient: some omplain readily and tend to exaggerate under stress or xcitement, others are stoical.

The history or story of the case can be obtained either rom the patient (if conscious) or from eye-witnesses: this nay throw light on the circumstances of the accident or llness that may be helpful in determining what is the natter and the degree of its severity.

In severe accidents it is necessary to determine whether he patient is alive or dead; if in doubt, treat as if he were live. In the case of cycle, motor, or aircraft accidents nusual injuries may be met with, which will not be ientioned in this book, and it will often be difficult to ssess the condition. Again the first-aider may be unable distinguish whether an unconscious patient has had an poplectic fit, taken poison, or is dead drunk. Under such rcumstances, medical aid must be obtained as quickly as ossible; in the meanwhile, unless poisoning is evident ee para. 9, page 7), nothing should be done other than lay the patient flat with his head to one side, so as to revent any vomited material from choking him; at the ame time he should be kept warm and protected against the lements, and steps should be taken to prevent the patient rom doing anything that might make him worse.

THE DUTIES OF THE FIRST-AIDER

In addition to applying first aid to the patient, there ar other important duties to be carried out by the first-aider and, while aid is being rendered, thought and action mus be given to them, using suitable onlookers as helpers These duties are as follows:

1. **To communicate with a doctor or hospital an the police** as soon as possible and by the quickes method available — that is, by telephone or a messenger stating the exact spot where the casualty is to be found its nature, and any special help necessary. A writte message is better than one by word of mouth which i apt to be garbled.
2. **To decide how the patient is to be lifted an carried.** Cases of serious fractures and injuries mus remain where they are until a stretcher is available o improvised; whereas patients with simple bruises, cuts and minor fractures can be moved by suitable means to appropriate surroundings at a little distance befor giving first aid.
3. **To decide where the patient is to be taken**, that is whether the patient should be

   (i) allowed to rest where he is until the doctor arrives
   (ii) conveyed to a house near by or to his own home;
   (iii) taken to a doctor's house or to hospital.

   Should it be decided to take the patient to a house, th first-aider must tactfully suggest the most suitable room to use, preferably one with a bed or couch. If necessary a fire should be lit, and such things as splints or a leg cradle should be improvised pending the doctor's arrival When a patient is being taken to his own home, a care fully worded message should be sent in advance (se Chapter XXIII).
4. **To arrange for transportation.** A decision regardin the suitability of transport available depends largely o

the type of case, the nature of the country, and the distance to be travelled. In cities and many large towns there is a service of motor ambulances, which can be obtained quickly by telephoning. Most hospitals have an ambulance in their yard. Buses can be used for stretcher cases, but they are liable to jar the patient, so, if there is not great urgency, it is better to wait for an appropriate vehicle. The average private motor-car is not suitable for stretcher cases. In emergency, a railway wagon or commercial vehicle can be used. In the country, a hay-cart can be arranged to carry a stretcher, or the patient may simply be placed on hay or straw on the floor of the vehicle.

5. **To make a concise report** to the doctor or hospital on handing over the case, stating clearly the injuries noted, what first aid has been given, and any relevant circumstantial knowledge of the accident or illness.
6. **To stand by and help the doctor** or police, if necessary, after handing over the case.

Legal questions may arise in certain cases. If there are suspicious circumstances, such as poisoning or an inflicted wound, try to detain witnesses and those concerned until the police arrive. Any bottles that may have contained poison or any weapon used to inflict a wound should be left untouched until arrival of the police. This aspect of the case, however, must not interfere with first aid.

Removal of clothing should, as already explained, be reduced to a minimum to lessen the risk of shock. Such clothing as must be removed should be dealt with along the following lines:

Coat: slip it off from the sound side first, then, if necessary, slit up the seam of the sleeve of the injured side, and remove.

Shirt and vest: slit down front and remove first from the sound side, then from the injured side.

Trousers and underpants: slit up the outer seam.

Sock: cut it off, if necessary.

SUMMARY OF ESSENTIALS OF FIRST

The main points to remember in connection with aid are:

1. **Go immediately to the aid of the casualty**, a early minutes are often vital, especially when the severe bleeding, interference or stoppage of breat or poisoning.

2. **Send for a doctor or an ambulance** at onc necessary, using an onlooker as messenger. Sen

FIG. 2.—SHOCK—LAY PATIENT FLAT OR WITH LEGS RAISE

onlookers on errands is a tactful way of dispers them.

3. **Be calm and courteous and act with comm sense**, so as to make the patient as comfortable a cheerful as possible and have confidence in you.

   '**Do first things first**' should be your motto.

4. **Remove the cause of the injury** or the patient fr the cause, if it is still doing harm.

5. **Lay patient flat** to lessen strain on the heart, and w head to one side to help ensure a clear air-way.

6. **Keep patient warm** by means of wrappings unde neath as well as above, and protect against the weath to lessen shock (Fig. 2).

7. **Control severe bleeding immediately** or death w quickly occur (see Chapter IV).

8. **See that the air-way is clear and apply artifici respiration** to all cases where there is stoppage

breathing. The air-way may be blocked by food as in choking, by water as in a case of near drowning, or by the tongue or false teeth falling back in the unconscious (see Chapter VII).

Dilute poisons immediately with copious draughts of water, baking soda in water, salt in water, or milk; then tickle back of the throat to induce vomiting. Antidotes can follow to help neutralise the poison if it is known (see Chapter XXI).

10. **Prevent shock** by laying the patient flat, keeping him warm, allaying pain, and giving appropriate fluids (see Chapter III).

11. **Immobilise all fractures** before moving patient from site of accident, except in cases where the patient may receive further injuries by remaining where he is, for example, injury from a burning house (see Chapter XV).

12. **Arrange for transport** — pick-a-back, stretcher, cart, motor-car, or ambulance, depending on the nature of the injuries and on local circumstances (see *Administration Manual*).

First aid when properly given, plays a very important art in the degree and rate of recovery of many a casualty, nd it may be the means of saving life. There must, hower, be no attempt to give more than first aid, or serious arm is apt to be done.

CHAPTER II

CIRCULATORY SYSTEM

THE two commonest conditions met with by the first-aide are bleeding and shock, the latter being associated wit failure of the circulatory system. To deal with these subject adequately, it is essential to have some knowledge of th blood and the channels through which it passes round th body.

THE BLOOD

Blood is a dark-red, sticky fluid which is circulate throughout the body by the pumping action of the heart.

Its main **functions** are to carry oxygen from the lung and food and fluids from the intestines to nourish the body tissues, and to remove the waste products of tissue activit for excretion in the urine, breath, and skin. The bloo also helps to maintain and regulate the temperature of th body, somewhat after the manner of a hot-water syster of heating.

The **amount of blood** is important, as the circulatio cannot function properly with only partially filled pipe The healthy body contains about a pint of blood for ever stone in weight (1 pint to 15 lb.). A normal man has som 10-12 pints of blood. The loss of 2 pints of blood at on time is serious, and more than that is likely to cause deat unless quickly replaced by a blood transfusion.

The **blood is composed** of fluid (called plasma) an solids (termed cells or corpuscles).

1. **Plasma** is a yellow fluid somewhat like that seen in blister; it carries food to the cells of the body which bathes and then takes away the waste products.

. **Blood-cells** are of two main types:

(i) **Red blood corpuscles**, which convey oxygen from the air in the lungs to all living cells of the body and carry away carbon dioxide on their return journey to the lungs. They are very small disc-shaped bodies, there being some 5 millions of them to a cubic millimetre of blood. (The letter 'N' here is about a millimetre in size.)

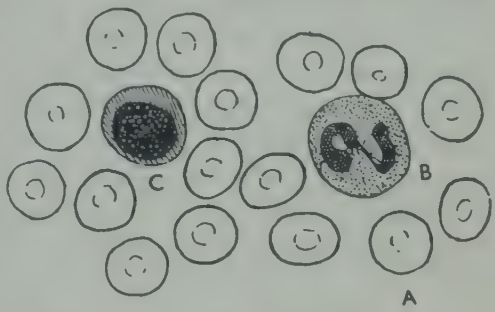


FIG. 3.—RED AND WHITE CELLS OF THE BLOOD (magnified about 800 times)

(ii) **White blood corpuscles** or **leucocytes**, which are chiefly concerned in scavenging injurious materials and in fighting germs which try to invade the body. They are larger in size but much fewer in number than the red cells, there being about 7000 of them to the cubic millimetre (Fig. 3).

Blood clots usually within 3 to 6 minutes of being ed. This is due to chemical substances in the plasma coming active when out of contact with the living cells ich line the blood-vessels. A fine network of fibres **brin)** forms in the plasma, turning most of it solid d entangling the blood-cells. As the blood clots a little lowish fluid **(serum)** is squeezed out. Bleeding ceases ially as the result of the clotting of blood over the damd blood-vessel. The slower the flow of blood, the better the chance of the fibrin setting. It is partly for this son that pressure should be applied to a bleeding point. e clotting property of blood is greatly diminished in ne people, termed **bleeders** or **haemophilics**, who may ed to death even from a trivial wound.

CIRCULATION OF THE BLOOD

The blood circulates from the heart, through arteri capillaries, and veins. The **heart** pumps the blood i thick-walled, elastic tubes, called **arteries**, which conv blood rich in oxygen and food to all parts of the body. T arteries divide and divide into ever smaller tubes like t branching of a tree: these end in fine, twig-like tub termed **capillaries**, whose walls are so thin that the fo and oxygen in the blood can pass through them to nouri the tissues, while waste matter, including carbon dioxi from the tissues, enters the blood-stream. The capillar are continued into minu vessels, called venules, a these join to form larger a larger veins, which fina take the blood back to t heart for purification and r circulation (see Fig. 4).

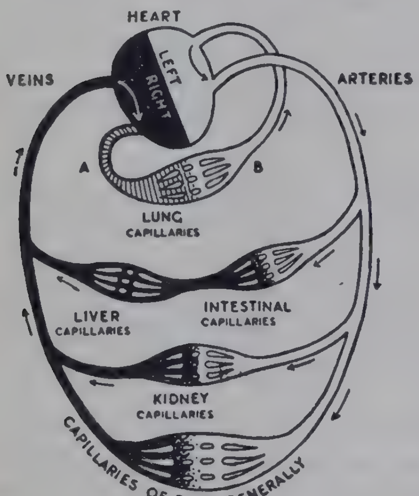


FIG. 4.—SIMPLE DIAGRAM OF THE CIRCULATION

THE HEART

The heart is a conica shaped, hollow, muscul organ which acts as a pun for the circulation. In si it corresponds approximat to that of the clenched fist its owner. It is situated the chest just behind the breast-bone **(sternum)** between the two lungs, and rests on the upper surfa of the **diaphragm**, which is a dome-shaped mus separating the chest from the abdomen. The heart obliquely in the chest, its base being in the mid-line a its apex just below and to the inner side of the left nipp where its beats can be felt. A quarter of the heart is the right side of the mid-line and three-quarters to the

(Fig. 5). It is surrounded by a transparent fibrous bag, :alled the pericardium. This consists of two layers; the nner fits tightly around the heart and is separated from he outer by a small quantity of fluid, which allows the ıeart to contract and expand without friction as it pumps.

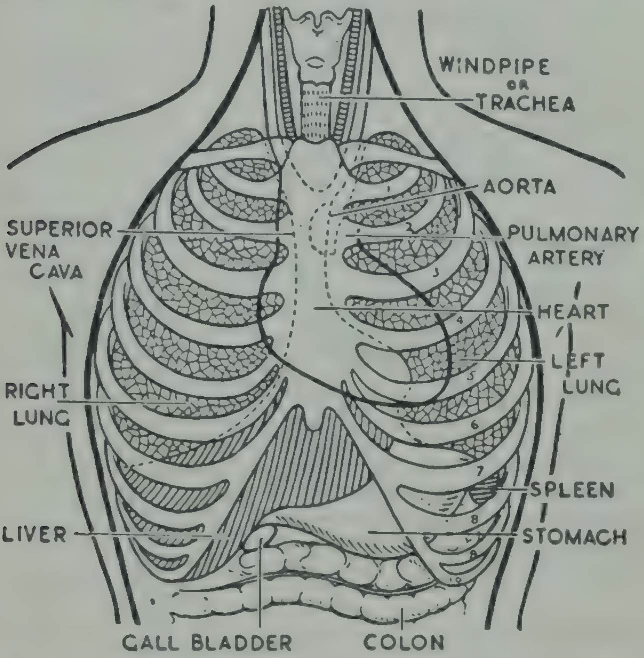


Fig. 5.—Relation of the Heart to Neighbouring Organs

The heart is divided lengthwise into two completely parate sides, right and left. Each side is divided into an per collecting chamber **(auricle)** and a lower, pumping amber **(ventricle)**, which communicate directly with e another through an opening guarded by a **valve** peritting the flow of blood in one direction only. There e thus four chambers, a right and left auricle and a ght and left ventricle: these are all provided with valves ensure a one-way traffic of blood. The heart is designed receive on its right side impure blood from the body enerally through two very large veins **(venae cavae)**, d to pump it through the lungs to dispel the carbon

dioxide and re-aerate it with oxygen, before it enters th left side purified for re-circulation throughout the body b way of the main artery, th **aorta** (Fig. 6).

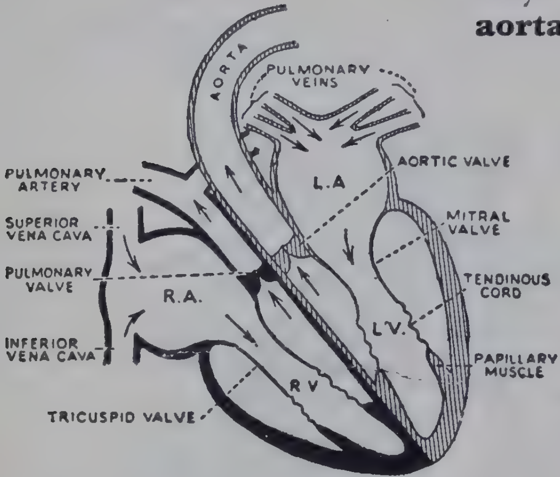


FIG. 6.—DIAGRAM SHOWING THE CIRCULATION OF BLOOD THROUGH THE HEART

Note.—(1) The auricles (R.A. and L.A.) and the ventricles (R.V. and L.V.). (2) The chief blood-vessels. (3) The valves, the edges of which are joined by strong tendinous cords to projections of the heart muscle. The arrows show the direction of the circulation

BLOOD-VESSEL

Arteries are vessels which conve blood from the hear to the organs an tissues of the body Their walls are relatively thick an composed of elastic muscular, and fib rous tissue (Fig. 7) They are like littl rubber tubes an expand readily wit each wave of bloo following each hear beat. These blood waves **(pulse)** can be felt by a finger placed on an arter lying directly over a bone. The usual method of taking th pulse is by placing the fore and middle fingers on the **radial artery** at the wrist, just at the base of the thumb. The pulse-rate varies, depending on the work the heart has to do to force the blood around the body. The pulse-rate of a normal adult is about 72 a minute while sitting, 60 when lying down, 80 when standin and 90 or more during exercise or heavy work. It

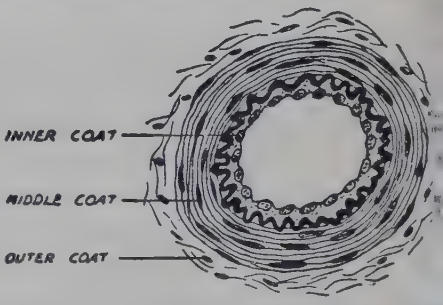


FIG. 7.—AN ARTERY SHOWING TH WALLS OR COATS

mportant in cases of bleeding to rest the patient, for then he heart will pump less frequently and so lessen the loss f blood.

Veins are blood-vessels which carry blood to the heart. 'hey are similar in size to the arteries they accompany, but ieir walls are much thinner and collapse like a canvas ose-pipe when the volume of blood is small. Veins have no ulse-wave, as this has spent itself by friction in the arteries nd capillaries, so the pressure of blood in them is low. In ict, the final flow of the lood in the veins openig into the heart is irgely due to suction s the auricles dilate. Ioreover, unlike arries, the veins of the mbs have a series of alves, to prevent the ood from flowing in ie reverse direction — iat is, towards the round through the efcts of gravity. Standg still for long periods uses blood to collect the veins of the leg d may lead to the velopment of varicose veins (Fig. 8).

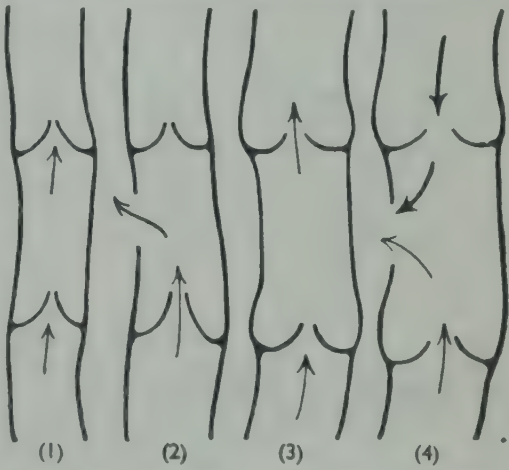


FIG. 8.—VALVES AND WOUNDS OF VEINS

(1) Vein with valves. (2) Course of blood coming from lower end of cut vein. (3) Varicose vein. (4) Wound, in varicose vein, showing how blood may flow from both ends

Capillaries are blood-vessels of microscopic size anged as a network connecting the very smallest arteries d veins in the various organs and tissues of the body. iey have very thin walls, composed of delicate cells placed e by side like paving-stones. Through these capillaries triment and oxygen in the blood diffuses to the tissues, d waste products, including carbon dioxide gas, pass into e blood for disposal by the kidneys, lungs, and skin. Any ood fluid that filters through these capillaries and bathes e tissues is colourless, and is termed **lymph**. Where capil-

laries are damaged, as by a prick of a needle, blood oozes o
and the flow is so slow that clotting normally occurs quickl

BLOOD CIRCULATORY SYSTEMS

There are three distinct blood circulatory systems in th
body (Fig. 9).

1. The **general or systemic system** which includes a
the blood-vessels of the bod
except those of the lungs ar
liver.

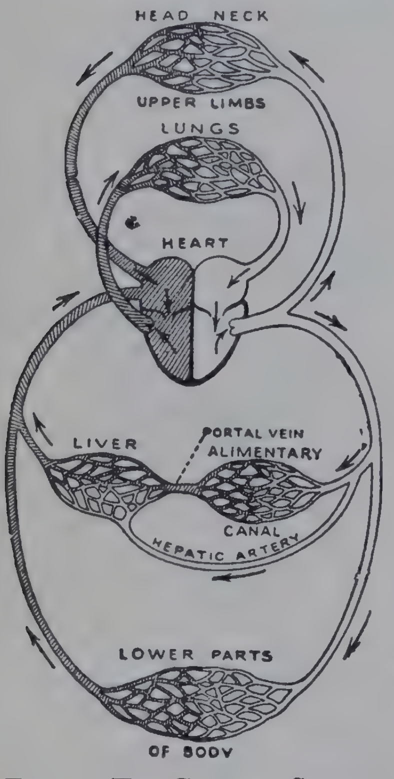


FIG. 9.—THE GENERAL SCHEME OF THE CIRCULATION

Note.—(1) The pulmonary and portal circulations are shown in addition to the general. (2) The arrows show the direction of the circulation. (3) The shaded portions represent venous blood

2. The **pulmonary syste**
which carries blood to ar
from the lungs. The bloo
which passes to the lungs
dark and impure, as it co
tains much carbon dioxi
gas and little oxyge
whereas that leaving th
lungs to return to the hea
is purified and bright re
being rich in oxygen. Th
change takes place in th
thin-walled air-sacs of th
lung where the blood capi
laries form a network arou
them.

3. The **portal system**
which all the blood from th
stomach, intestines, pa
creas, and spleen passes
the liver by the **portal vei**
This vein divides into ma
capillaries in the substan
of the liver, and here certa
food substances are retain
in storage for future use, and some poisons and toxins,
present, are disposed of. The 'filtered' blood passes fr
the liver to the **inferior vena cava** to enter the right auric

CHAPTER III

SHOCK

HE commonest cause of death after an accident is shock. me degree of shock follows every injury, hence it is called **raumatic shock'**; it may be imperceptible after minor uries, or great where the injury is severe. Moreover, the gree of shock varies with individuals, depending on their nperament and sensitivity — some feel pain more readily ın others, especially emotional people. Resistance to ɔck-producing conditions is low in the very young and ed, in the feeble and those suffering from anaemia, and ıen tired, hungry, or cold.

PRIMARY AND SECONDARY SHOCK

There are two forms of traumatic shock, primary and ondary. **Primary shock** occurs immediately or shortly er an injury and is quickly recovered from if properly ıted. **Secondary shock**, if it develops, comes on later, ally within half an hour to six hours of the injury: it is a y serious condition and is frequently fatal. It is most ɔortant, therefore, that the first-aider should have a ır conception of shock and do everything possible to en it or prevent the development of the secondary form.

ause of shock: Severe shock follows abdominal injuries;
bleedings that are profuse;
burns in proportion to the extent of skin involved;
broken bones, especially when the fracture is severe or improperly handled;
bomb and bullet wounds and blast effects;
chest injuries, particularly of the crush type, and cranial injuries as from a blow on the head.

Primary shock is the result of excessive stimulation nerves at the point of injury affecting the vital centres the base of the brain, especially those controlling circulation. Fright and fear tend to aggravate the con tion. As a consequence, the blood-pressure falls and blood-vessels generally are incompletely filled. In attempt to counteract this, the heart beats faster to pu more blood into the blood-vessels and the small arte contract, so there is less than the normal amount of bl in the skin, which therefore is pale and feels cold. secondary shock similar factors are at work, but the c dition is made worse by the development in the body chemical substances which are shock-producing. Th substances are liable to cause a fatal result from continu circulatory failure, as much of the fluid of the blood pas into the tissues as lymph (see page 118), the walls of capillaries becoming more and more permeable as result of deficient oxygen supply. In this way, the volu of the circulating blood gets less and less. This is partic larly likely to occur in cases of bad burns where the cap laries are damaged by the burning.

Signs and symptoms of shock depend on the deg of injury. In slight cases the individual may be mer more talkative than usual, excited, or shaky with a feeli of faintness. In some cases there may be collapse. T common signs and symptoms of primary shock are:

(1) pallor of face and lips;
(2) beads of sweat on the forehead;
(3) clamminess of the skin;
(4) cold hands and feet;
(5) rapid and feeble pulse; and
(6) shallow, sighing breathing.

These symptoms usually pass off in a short time, they may persist despite treatment, or suddenly reapp an hour or so after the accident. This indicates the o of secondary shock, which is most serious. Here the s and symptoms of primary shock are intensified and

mperature is below normal, there is thirst, vomiting, stlessness, apathy, vacant expression, and later uncon-ousness possibly leading to death.

rst aid treatment

In every case of injury, shock must be guarded against. should be remembered that nature's reaction is to try raise the blood-pressure so as to supply enough blood to vital centres in the brain. Therefore, cases of injury ould lie down until the stage of primary shock is over, as licated by return of colour to the face and improvement the pulse. It is an advantage to raise the legs (if not ctured) on a cushion, or by supporting the foot-end of stretcher or bed about 9 inches off the ground.

Great care should be taken not to increase the injury cause pain by unnecessary or rough handling of the ient, or by clumsy lifting, or bumpy transportation. It undesirable to move a patient until the shock has passed.

Any bleeding should be stopped quickly, otherwise ondary shock is likely to develop. The patient should be t covered as much as possible at all times.

It is important to keep the patient warm but not to rheat, as this would dilate the blood-vessels of the skin upset nature's attempt to overcome shock by raising blood-pressure, as explained above. The best way keep patients reasonably warm is to allow them to in their clothes. If it is necessary to expose any part he body, this can usually be done sufficiently for first purposes by turning up the clothing, dividing it at a n, or by partial removal only. Blankets, rugs, or coats ld be used as wraps, and it is of the utmost importance ave plenty of wrappings under the patient to prevent from the ground penetrating (see Fig. 10). Hot-water les help to retain the body heat, but these must be well red and separated from the patient by his clothing: heat must not be excessive as sweating must be avoided. Drinks of hot tea or coffee help to maintain the body and replace the fluids lost, but no drink should be

given to unconscious patients or those with penetrat
wounds of chest or abdomen.

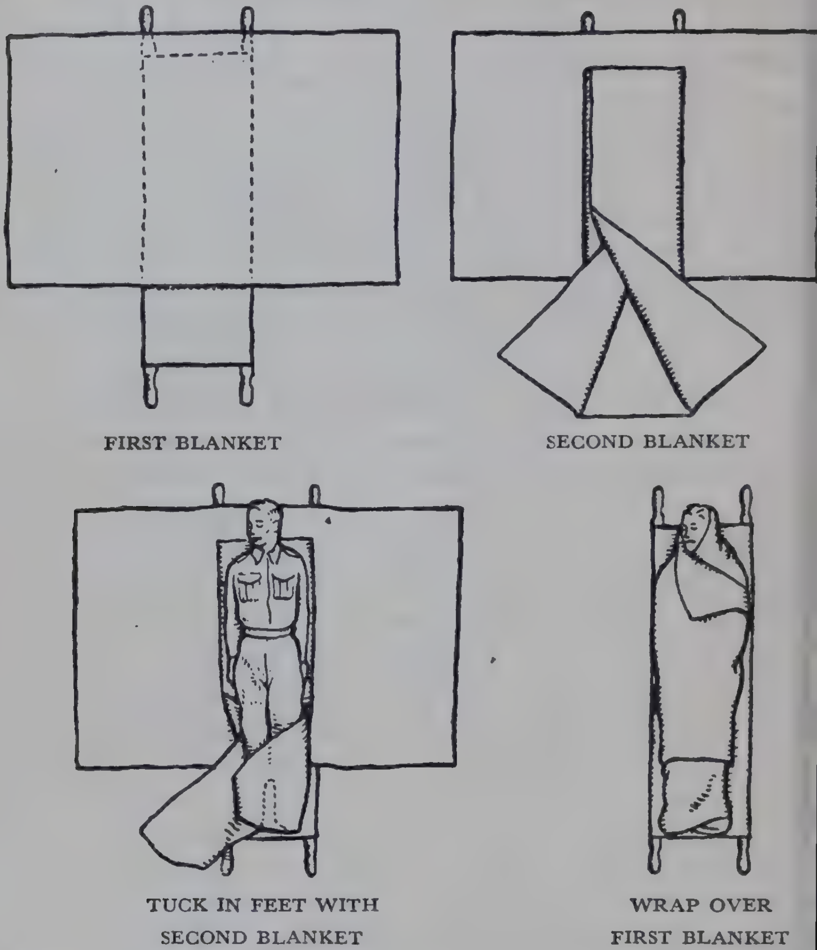


FIG. 10.—BEST USE OF TWO BLANKETS TO KEEP A PATIENT WAR

To summarise the first aid treatment for trauma shock:

1. **Lay patient flat** with head to one side and legs eleva about 9 inches, unless they are fractured, in which wait till the fracture is immobilised.
2. **Stop any bleeding.**
3. **Loosen clothing at neck and waist.**

.. **Keep warm** — therefore, **do not remove** clothing; wrap round with blankets, rugs, or coats; give hot-water bottles, if available, but do not overheat to the point of sweating.

. **Handle** as gently as possible and avoid any unnecessary movements.

. See there is **plenty of air,** and protect against any inclemency of weather.

. **Give drinks of hot tea or coffee**, if there is no chest or abdominal injury.

. Be cheerful and **support morale.**

. Get a **doctor or send to hospital** as soon as possible.

FAINTING or SYNCOPE

Fainting or syncope is a condition of mild collapse much kin to primary shock as regards its signs, symptoms, and echanism. However, it passes off within a few minutes nd is not usually dangerous.

Cause of fainting. A faint is due to an insufficient pply of blood to the brain, following a sudden lowering the blood-pressure. This lowered pressure follows an pset of the nerve centres controlling the heart and blood-ssels. Without its blood-supply the brain cannot function operly for more than a few seconds. That is why an iator may become momentarily blind or even uncon-cous during very tight turns in aerobatics, if the turn is olonged beyond 5 seconds.

Frights, horrifying sights, bad news, or pain are apt to d to faints, especially if the blood-pressure has been vered by illness, or by standing still on parades or in wds, or sitting for a long time in hot, stuffy atmospheres in church or at concerts. Under such conditions, much the blood gravitates to the lower part of the body, so it the heart is insufficiently filled to pump enough blood ainst gravity to the brain. Fatigue and hunger aggra-te the condition.

Signs and symptoms of fainting. The sufferer's

face is pale with beads of perspiration on the forehead. H feels giddy and vision becomes blurred; soon he becom limp and flops unconscious to the ground. His pulse now rapid and feeble, and the breathing is so shallow as be imperceptible.

First aid treatment

1. **When a person feels faint while standing**, la him down, loosen the clothes round neck and waist, an give him some water to drink. If he cannot be put fla make him sit with his head bent forward between the knee This treatment makes it easier for the heart to pump th blood to the brain.

2. **When fainting occurs indoors, as in churc concert, or theatre**, the patient should be lifted off th hard, draughty floor and placed on chairs or a sofa wit his feet raised higher than his head, if possible, so as encourage the flow of blood to the brain. Clothing shoul be loosened round neck and waist to avoid any constrictio which might impede the return of blood to the heart. Th head should be turned to one side to prevent the tongu falling back and obstructing the breathing. The fac should be bathed with cold water if available and th patient given a drink of water, tea, coffee, or sal volati (a teaspoonful in a cup of water), if conscious. Whe recovery has taken place, as indicated by the return colour to the face and a normal pulse-rate, the patie should be removed for a short while to another room, whi is not stuffy, before going home to lie down: immedia return to the scene of the incident is inadvisable, as fainti may recur.

3. **When a person faints in a crowd,** such as a lar sports gathering, it may be necessary to pass the individu horizontally over the heads of the crowd to a convenie place outside where treatment can be given.

To summarise the first aid treatment for fainting

1. If the patient has not lost consciousness, **sit him dow**

and lower his head between the knees; **or lay him down** with the head lower than the feet.

If unconscious, lay the patient down as in 1.

Remove any false teeth.

Loosen clothing at neck and waist.

Allow plenty of **fresh air**.

Keep body warm.

Sprinkle cold water on face.

Hold smelling salts to nostrils.

When consciousness returns, gradually raise the patient and give **sips of water, tea, or coffee**.

ELECTRIC SHOCK

It is convenient now to consider electric shock, as the ual shock condition necessitates treatment similar to it given for traumatic shock. The main difference ween electric and traumatic shock is that the electric rent is liable to act first on the breathing or respiratory itre in the brain and cause a sudden stoppage of breathing paralysing the muscles of respiration. The brain centre itrolling the heart and circulation may, however, escape, the heart may continue to function though the breathing stopped. It is for this reason that in electric shock the is blue, not white, and that artificial respiration must carried out for some hours, if necessary. As long as the rt beats there is hope of saving life. When the circulatory re in the brain is affected as well as the respiratory, e is sudden death.

Electric shock results from contact with a live and naked tric wire, cable, or rail, as may occur with electrical uits and apparatus in the home or in industry, or by ll on a live electric rail. The immediate effect of the current passing through the body is shock — this may elatively mild or so severe as to cause immediate death lectrocution, depending on the strength of the current whether surroundings are dry or wet. Moisture is a erful conductor of electricity and accentuates the shock

effect. Another result of contact with electricity is burni particularly at the site of contact: these burns may be de

First aid treatment of cases of electric shock nec sitates very prompt action in the following order. Fi the electric current should be switched off or the pati removed from contact with the current. Then artific respiration should be applied immediately, for several ho if necessary. Meanwhile, anti-shock and anti-burn tre ment should be applied, as detailed at pages 17–19 a 145 respectively.

Removal of the patient from contact with electr current is a very dangerous procedure and full precautic must be taken in an endeavour to free the victim quicl from contact with the electric current.

When possible the current should be switched off, b unfortunately the switch may not be close by the accide so it may be necessary to move the body away from t current.

To do this necessitates the use of insulating materia Thick rubber gloves as are used by those engaged in repa ing electric wires are ideal as non-conductors of elect current. These may be available in workshops, and wi them it is safe to drag the person away from a live wire rail. At the same time it is essential to stand on so insulating material, such as rubber-soled shoes or boots, a mackintosh folded several times and placed on t ground. The soles of the boots or shoes should, of cou be dry.

While standing on this insulating material, the pati should be removed from contact with the electric curr by means of some non-conducting material, such as a walking-stick (not an umbrella which has metal ribs) dry board, or a dry rope. In each instance it is advisa to hold the stick or other implement in the folds o mackintosh or in a rubber tobacco-pouch. When pul the body away, the armpits should be avoided as they ar often moist. It is most dangerous to use bare hands at a time (see Fig. 11); an ordinary glove gives fair protecti

After the apparent recovery of a case from electric shock, the patient should be seen by a doctor to ensure that all is well, as electric shock cases are liable to relapse even when the condition has appeared to be mild.

Lightning may produce similar effects to those of a strong electric current. Instantaneous death or paralysis may occur. There is shock and burning, and the first aid treatment is the same as that for electric shock.

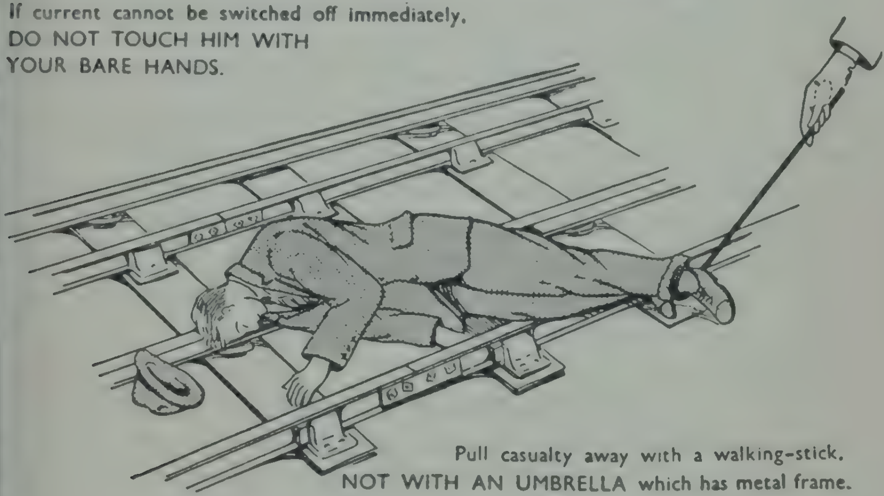


FIG. 11.—FIRST AID FOR ELECTRIC SHOCK

To summarise the first aid treatment of electric shock :

Remove the patient from contact with the electric current, but **do not touch him with your bare hands** —

(i) **Switch off the current**, if possible.

(ii) If this cannot be done, stand on **some insulating material** such as a dry folded mackintosh.

(iii) Pull the casualty away by means of a **dry rope or walking-stick** (not an umbrella which has metal ribs).

If breathing has stopped, give **artificial respiration** for several hours, if necessary.

3. **Treat for shock** as soon as possible.
4. **Treat any burns.**
5. **Transfer to hospital** when fit to move.

INSULIN SHOCK

Another form of shock is that which may occur in diabetics who are on insulin treatment. When insulin is given, the dose is so regulated for the individual's diet and work as to lower the amount of sugar in the blood to normal levels. This lowering of the sugar content of the blood may be overdone as a result of the patient omitting a meal or not having one at the proper time after a dose of insulin, an error in the dosage of insulin, or too much physical work or exercise using up too much blood-sugar.

The lowering of the blood-sugar below the normal is termed **hypoglycaemia** and is manifest by symptoms referred to as insulin shock, which if it occurs is usually within 4 hours of an injection.

The **signs and symptoms** of insulin shock are tremors, pallor, sweating, and a sensation of sickness, followed by a confused state as if drunk — the patient may be jocular, agitated, or pugnacious. If not treated promptly, twitchings, convulsions, unconsciousness, or death will occur.

First aid treatment is simple and recovery is rapid. Treatment consists of giving two lumps or teaspoonfuls of sugar in a cup of water. The case should then be referred to a doctor for further regulation of insulin, diet, etc.

CHAPTER IV

BLEEDING OR HAEMORRHAGE IN GENERAL

VARIETIES OF HAEMORRHAGE

AFTER shock, bleeding is the commonest cause of death in the case of accidents and wounds generally. If the bleeding is from the surface of the body, it is called **external haemorrhage**; whereas bleeding within the chest or abdomen is not visible immediately and is, therefore, termed **concealed** or **internal haemorrhage**. Internal bleedings to begin with can only be diagnosed by general symptoms, but later blood may trickle from the nose or ear from a fractured skull, or be coughed up from the lungs, or vomited from the stomach.

Bleeding occurs immediately after the rupture of any blood-vessel whether it be artery, vein, or capillary: this is **primary haemorrhage**. The degree of bleeding is roughly proportionate to the size of the vessel cut and, of course, is greater from arteries where the blood-pressure is high than from veins in which the pressure is low. Mild bleeding ceases normally in a matter of minutes as the result of the walls of the torn or severed vessels contracting and being sealed by blood-clot. In severe cases it is necessary to assist this natural process by the application of pressure directly to the wound or indirectly to the main blood-vessel concerned. Haemorrhage from a large artery may be fatal in a few seconds if it is not controlled.

In some cases bleeding may recur up to 24 hours after accidents in which there is severe shock, owing to the blood-clot being displaced from the vessel when the heart regains its force as the shock passes off. This is called **reactionary**

haemorrhage and is made manifest by blood soaking th dressing and by general symptoms of collapse.

If sepsis occurs in a wound, the blood-clot may b gradually broken down by the process or the walls of blood vessels may be eroded, with the result that bleeding recu after several days: this is **secondary haemorrhage** The first-aider is more concerned with primary haemor rhage than secondary, as in the latter case the patient i usually in hospital.

There are three main types of haemorrhage: arterial capillary, and venous—the chief differences being tha when an artery is cut the blood spurts in jets from a surfac wound or wells up in a deep one in time with the hear beat, the blood being scarlet as it contains much oxygen whereas with venous bleeding there is a continuous flov of dark-red blood. Capillary bleeding occurs usually a a slow or fast oozing, and is the easiest to control.

VARIETIES OF HAEMORRHAGE

1. **External** 2. **Internal** (concealed)	(i) **Primary** occurs immediately	(a) Arterial (b) Capillary (c) Venous
	(ii) **Reactionary** occurs within 24 hours, is due to displacement of blood-clot	Arterial
	(iii) **Secondary** occurs days after injury, is due to sepsis opening blood-vessels	(a) Arterial (b) Capillary (c) Venous

GENERAL SIGNS AND SYMPTOMS OF HAEMORRHAGE

In addition to the bleeding which may or may not b visible, there are general signs and symptoms which va in degree, depending on the amount of bleeding and i site. A bleeding inside a small cavity like the skull wi have greater effect on the individual than a bleeding similar size in the chest or abdomen. The symptoms moderate or severe haemorrhage are very similar to thos of shock, as is to be expected from the loss of blood-volum

d defective blood-supply to the tissues generally. In es of internal haemorrhage these general symptoms may the only initial clue to the condition.

The general symptoms of serious haemorrhage are:

The skin is cold, clammy, and pale.

The pulse is rapid and difficult to feel.

The patient feels faint and is anxious and fidgety.

The patient gasps for breath **(air hunger)** and sighs deeply.

There is profuse sweating, especially of the forehead.

Thirst is marked as a result of the loss of fluid by bleeding and sweating.

Dimness of vision follows the lack of oxygenated blood to the brain.

There is increasing drowsiness leading to unconsciousness.

Air hunger and dimness of vision do not occur with ple shock and should indicate to the first-aider the ousness of the case. Such collapsed patients should be ated where they are, if at all possible, and if moved this st be done with the greatest care as the least jolt may fatal.

GENERAL FIRST AID TREATMENT OF HAEMORRHAGE

he first aid treatment for haemorrhage depends on the ee of bleeding and its site, that is, whether it is external ternal and whether arterial, venous, or capillary.

1. **CAPILLARY HAEMORRHAGE** (as seen in grazes)

Lay patient down and **raise the limb** if bleeding, provided there is no fracture.

Wash your hands, if possible, or swab them over with disinfectant — but do not touch wound with your fingers.

Expose the bleeding point and, if no foreign body is present, apply direct pressure with a clean dressing to control the bleeding.

(iv) **Apply a gauze pad** and bandage this firmly over th bleeding point. If the blood soaks through this dres ing, apply another over it.

(v) **If foreign bodies**, such as glass or gravel, are prese in the wound, remove only those that are loose: c not attempt to move any that are fixed, as this ma cause further damage. Control the bleeding by ten porary pressure on the main artery above the woun and apply a ring bandage around the bleeding are cover with a clean dressing and lightly bandage th on (Fig. 12).

(vi) Keep patient warm and **treat for shock** (see pag 17–19).

2. VENOUS HAEMORRHAGE

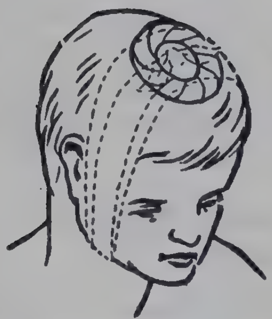


FIG. 12.—DRESSING OVER WOUND CONTAINING GLASS

For example, this may occur fro a ruptured varicose vein of the le and the bleeding will be profu and dangerous, even fatal, if n treated promptly, as the valves the dilated vein fail to act (Fig. 8 First aid treatment should be follows:

(i) **Act immediately** and quickly as possible.

(ii) **Lay patient flat** and **rai leg** or affected part vertical to lessen the flow of blood to it.

(iii) **Loosen any constriction,** such as garters, on t heart side of the wound.

(iv) **Apply a clean pad** over the bleeding point and ban age it on firmly, so as to press well down into the woun

(v) Treat for **shock.**

(vi) **Keep limb raised** until case is transferred to th care of a doctor or hospital (see Fig. 13).

3. ARTERIAL HAEMORRHAGE

Arterial bleeding is always dangerous as a large amount of blood may spurt out in a very short time, leading to rapid collapse and possibly death. Injury to the main blood-vessel **(aorta)**, as may occur from a stab wound in the chest or abdomen, is likely to cause immediate death. A cut-throat wound involving the large arteries of the

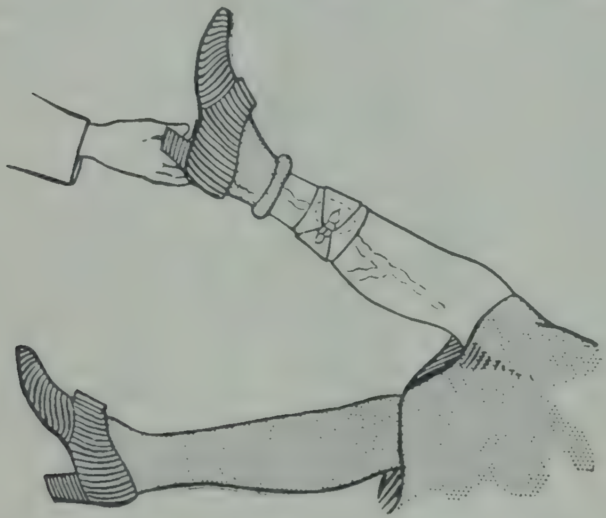


FIG. 13.—FIRST AID FOR BURST VARICOSE VEIN OF LEG

neck **(carotids)** may cause death within a minute, if not treated, as is also the case with the large artery of the upper leg **(femoral artery)** and that of the upper arm **(brachial artery)**. Immediate treatment is essential to save life in arterial haemorrhage, even when it is from smaller vessels such as those of the lower arm **(radial** and **ulnar arteries)**, hand **(palmar arch)**, lower leg **(tibial arteries)**, and foot **(plantar arteries)** (see Fig. 14).

The patient with arterial haemorrhage usually flops down as a result of the shock of the injury or faintness from loss of blood. If this is not so—

(i) **Lay patient down** immediately.

(ii) There is no time to wash your hands in the case of

severe arterial haemorrhage, as you must **act immedately**: saving of life is more important than avoidanc of sepsis at this stage.

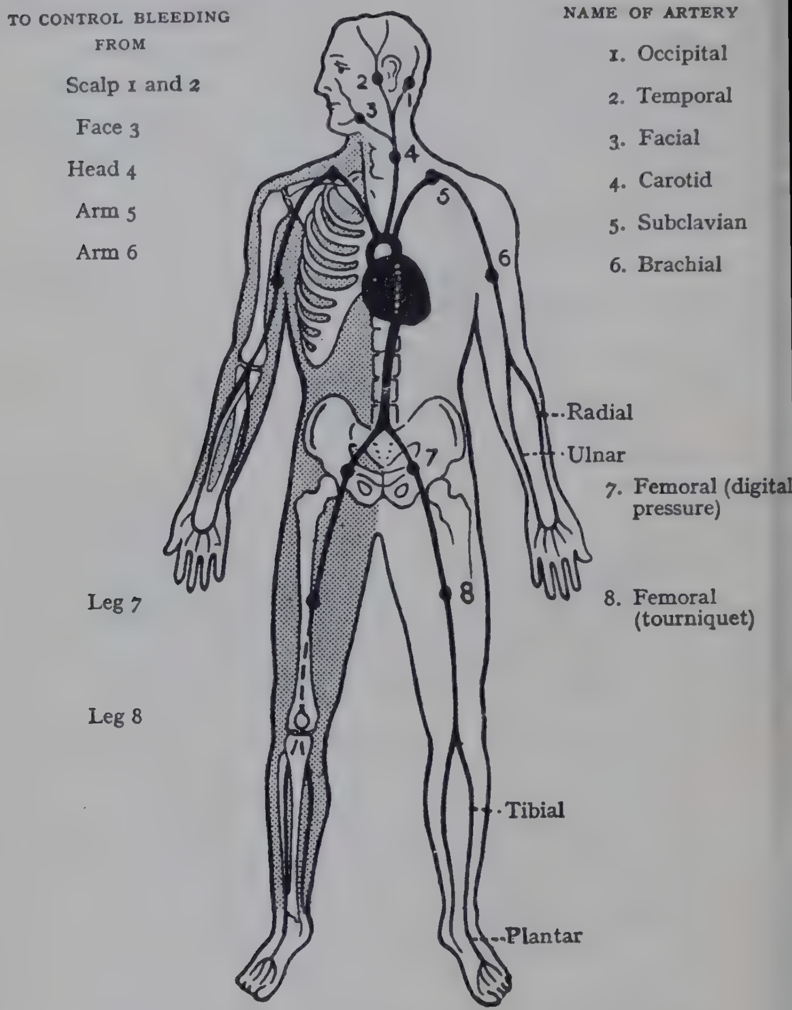


FIG. 14.—MAIN ARTERIAL PRESSURE POINTS

(iii) **Apply thumb or finger pressure** (digital) to t main artery concerned at the recognised pressu point over a bone on the heart side of the wound control the bleeding.

(iv) Maintain this digital pressure for 10 to 15 minut

while the assistant, who has washed his hands, very firmly **bandages a clean pad** over the wound (provided there is no foreign body like glass in it; if there is, treat as indicated at Fig. 12), or —

(v) until a **triangular bandage** can be placed in position to act as a **tourniquet** on either the upper arm or thigh in the case of severe bleeding from either an arm or leg.

(vi) **Loosen the tourniquet** slowly for 1 minute in every 15 till the bleeding stops, but leave it in position so that it can be tightened again should bleeding recur. The times of tightening tourniquet should be written down on a piece of paper (or label) attached to the patient, so as to ensure that it is not left on too long. Continued bleeding can be recognised by blood oozing through or trickling from the dressing.

(vii) Be careful **not to touch the wound with your fingers**, as this may lead to sepsis and secondary haemorrhage (see page 117).

(viii) **Treat for shock** or collapse, and support the injured part.

(ix) Get patient to **hospital** as soon as possible.

Before proceeding further, it is important that the first-[illegible]ler should know **when and how to apply a tourni-[illegible]et,** which is a most dangerous appliance if not properly [illegible]d.

The use of the tourniquet in first aid should be limited [illegible] cases of severe arterial haemorrhage from the limbs, and [illegible]n only in cases where elevation of the limb and digital [illegible]ssure over the artery fail to control the bleeding.

The chief dangers of using a tourniquet are:

[illegible]st, if applied **too tightly**, it will damage the tissues of the part, including the nerves, and so may cause palsy or loss of sensation, from which it may take months to recover.

[illegible]condly, if left on **too long**, degeneration or even death (**gangrene**) of the part will result, as all tissues suffer

in some degree when deprived of their blood-supply, t degree depending on the length of time of deprivation

Thirdly, if applied **too loosely**, it will not control t arterial bleeding but will probably interfere with t venous flow towards the heart, and so by backwa pressure increase any bleeding there may be from t veins accompanying the damaged artery.

The **best type of tourniquet** is one improvised fr a narrow-fold triangular bandage, a large handkerchief necktie, or broad belt. Elastic and other patent tourniquets are dangerous in the hands of the first-aic and should be avoided.

The **method of applying a tourniquet** is as follows

(*a*) A tourniquet must **never be applied to the ba skin**, but over such clothes as shirt-sleeve, pants, trousers.

(*b*) The limb, at the **level of middle of upper arm thigh**, should be encircled by a narrow-fold triangul bandage or a large handkerchief. There is no need complicate this by inserting a stone or a pad of cotto wool at the point where the tourniquet will press the artery — a stone may damage a nerve.

(*c*) The free ends of the bandage should be tied in a ha knot on the outer side of the limb, and **a penc short stick, or a spoon** should be placed on t half-knot and held in position by completing the re knot on top of it.

(*d*) Next, the pencil should **gradually be twisted** so to tighten the bandage until the bleeding stops, b no more (Figs. 15A and B).

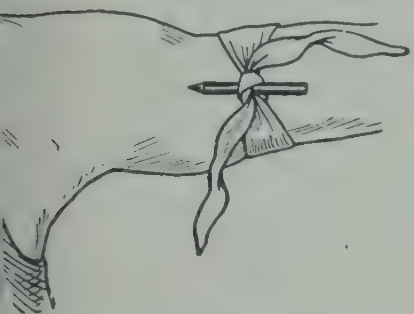
(*e*) A second bandage or handkerchief should be t round the limb to hold the pencil or stick in positi so as to prevent the tourniquet from untwisting.

(*f*) The tourniquet must be **loosened gently every minutes**, and left in place but not tightened ag unless bleeding continues.

(*g*) A **label** or piece of paper (envelope) should be attach

to the patient's coat, and on this should be recorded the times of each application of the tourniquet.

The patient should be **transferred to the care of a doctor or hospital** as soon as possible, and the first-aider who applied the tourniquet should remain with



.—IMPROVISED TOURNIQUET FOR RACHIAL ARTERY (BACK VIEW)

wisting the pencil or stick the band-is tightened up till the flow of blood through the arteries is stopped

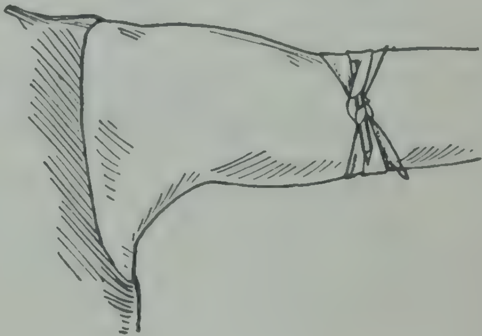


FIG. 15B.—TOURNIQUET WITH END OF TWISTING APPARATUS SECURED

the patient until this transfer, otherwise someone may forget that the tourniquet is still on.

The **pad and flexion** method of stopping the flow of od at the elbow and knee is not so effective as the use . tourniquet on the upper arm or thigh. Moreover, it iore uncomfortable and cannot be adopted in cases of ture. It is, therefore, not recommended.

NTERNAL HAEMORRHAGE is dealt with in Chapter VI.

CHAPTER V

EXTERNAL HAEMORRHAGE FROM VARIOUS PARTS OF THE BODY

THE general principles for the arrest of bleeding havi been dealt with, it is now necessary to know the positi of the main blood-vessels before considering the first a treatment for haemorrhage from various parts of the bod

COURSE OF THE MAIN ARTERIES

(Figs. 14 and 16 should be studied throughout this sectior

1. Arteries of the thorax and abdomen

The **aorta** is the largest artery of the body, being abo an inch in diameter. It arises from the left side of t heart, carrying blood rich in oxygen away from the l ventricle. It lies behind the breast-bone (sternum) at t level of the third rib and curves backwards in an arch lie in front of the left side of the spine. Here it pas down through the chest and abdomen to just below t level of the navel, where it divides into two larger arter **(iliac)** which supply blood to the pelvis and the le In the abdomen, the aorta gives off large branch arter to the stomach, intestines, liver, pancreas, spleen, a kidneys.

As death is almost instantaneous when the aorta ruptured, first aid does not arise in such cases.

2. Arteries of the head and neck

(i) The **common carotid arteries** arise from the ar of the aorta and lie one on either side of the windpi

(trachea) in the lower part of the neck where they can be felt pulsating just below the Adam's apple: this is the pressure point (Fig. 16). At the level of the Adam's apple (voice-box or larynx) each common carotid divides into two large arteries, the internal and external carotids.

(ii) The **internal carotid** supplies blood to the brain, the eyeball, the inner ear, and inside of the nose.

(iii) The **external carotid** conveys blood to the face, tongue, mouth, and scalp, and subdivides into three main branches—facial, temporal, and occipital (Fig. 20).

(iv) The **facial artery** supplies blood to the face below the level of the eye. It can be felt pulsating at the pressure point, as it lies over the lower jaw-bone about an inch in front of the angle of the jaw (Fig. 20).

(v) The **temporal artery** runs up towards the top and front of the head, passing over the temple on its way. Here it can be felt pulsating over the bony ridge about half an inch in front of the earhole. This is the pressure point to control bleeding (Fig. 20).

(vi) The **occipital artery** supplies blood to the back of the scalp and can be felt pulsating, at the pressure point, as it passes over the bony prominence about four finger-breadths behind the earhole (Fig. 20).

Arteries of the arm

(i) The **subclavian artery** arches outwards over the first rib immediately behind the collar-bone to enter the armpit, where it becomes the axillary artery. The subclavian can be felt pulsating, at the pressure point, on the first rib behind the centre of the collar-bone.

(ii) The **axillary artery** lies just below the shoulder-joint and can be felt pulsating at the top of the armpit, but this is not a satisfactory pressure point for first aid work. At the lower border of the armpit it becomes the brachial artery.

(iii) The **brachial artery** extends along the inner side of the arm from armpit to the front of the elbow, lying

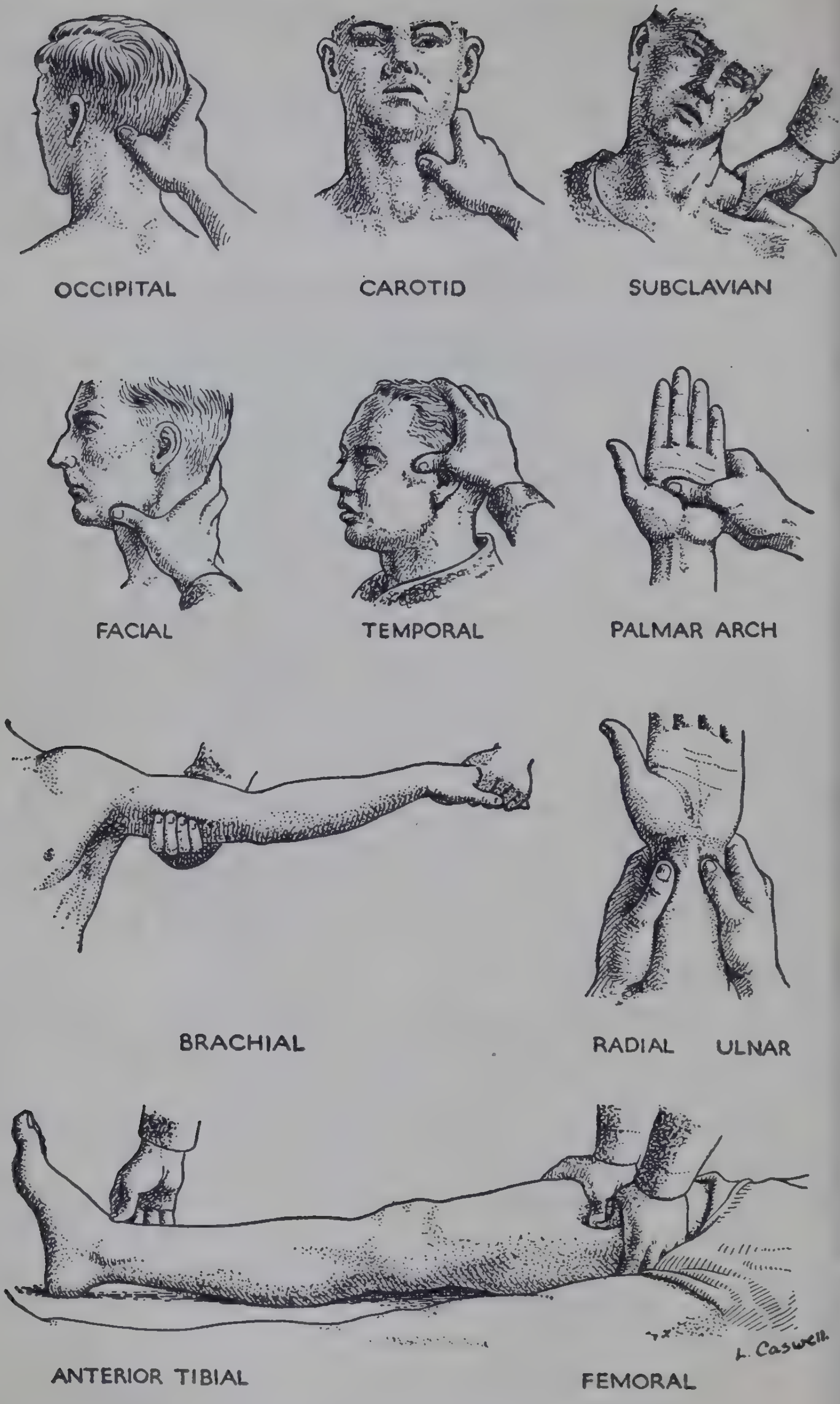


FIG. 16.—DIGITAL COMPRESSION OF ARTERIES TO CONTROL HAEMORRHAGE

in the groove formed by the biceps muscle, which roughly coincides with the inner seam of the coat-sleeve. Here it can be easily felt when compressed against the upper arm bone (humerus). The best point to apply pressure is in the middle third of the humerus. In front of the elbow-joint the brachial artery divides into radial and ulnar arteries.

The **radial artery** follows a line from the centre of the bend of the elbow to the base of the ball of the thumb. It lies in front of the radius bone, and can be felt here as the pulse about an inch above the crease of the wrist.

The **ulnar artery** passes down the inner side of the forearm in front of the ulna to enter the hand to join up with the radial artery to form

the **palmar arches** just underneath the ' life line ' of the palm. The arteries to the fingers arise from these arches (Fig. 17).

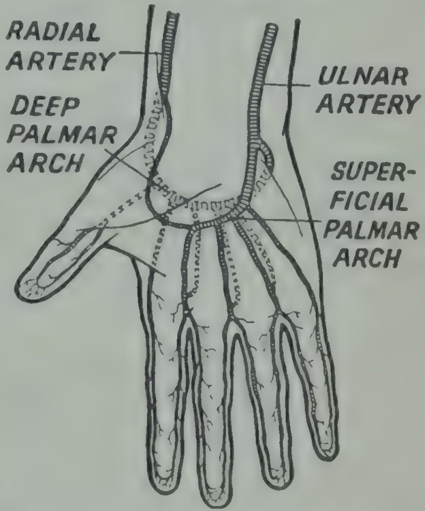


Fig. 17.—Arteries of the Wrist and Hand

Arteries of the leg

The **femoral artery** is a continuation of the external iliac artery as it leaves the abdomen at the centre of the fold of the groin. This is the pressure point, and here the artery can be felt pulsating as it lies over the pelvic bone. From the groin, the artery passes along the inner side of the thigh towards the inner side of the knee. In the lower third of the thigh it passes behind the knee, where it becomes

the **popliteal artery**, which just below the knee-joint

divides into two arteries, which pass down into t lower leg — one in front of and the other behind t bones, as the

(iii) **anterior tibial artery**, and

(iv) **posterior tibial artery**, which can be felt pulsati just behind the inner ankle. At the ankle th arteries form, respectively,

(v) the **dorsalis pedis** (dorsal artery of the foot) in fro of the ankle, and

(vi) the **plantar arteries** in the sole of the foot.

The **veins** have not been described. One or two them accompany each artery and for the most part be similar names, the main exceptions being the large vei conveying blood to the right side of the heart **(venae cava** the main veins of the neck **(jugular)**, those at the bend the elbow **(basilic)** and upper arm **(cephalic)**, and t large superficial veins of the legs **(saphenous)**.

FIRST AID TREATMENT OF EXTERNAL HAEMORRHAGES

Although it is essential to stop haemorrhage befo treating any wound, reasonable care must be taken prevent the wound becoming dirty or septic from clothi or handling. Hands and all dressings must, therefore, clean.

1. HEAD AND NECK HAEMORRHAGES

(i) **Haemorrhages from the scalp**, if from the for head, top of head, or temple, are due to woun involving the **temporal** artery; whereas bleedi from the back of the scalp comes from one of t **occipital** arteries. To stop the bleeding:

(*a*) **Keep the head raised.**

(*b*) Apply direct **pressure with the thumb on th wound**, the thumb being covered by a clea dressing if possible.

(*c*) With the other thumb, apply **pressure on the pressure point** of the temporal or occipital artery concerned (Fig. 16). If this does not control the bleeding, get another helper to press on either the two temporal or two occipital vessels.

(*d*) If there is **no fracture of skull** or foreign body in the wound, apply **pad and bandage** over the wound, using a narrow-fold bandage. In the case

FIG. 18.—BANDAGE APPLIED TO THE BACK OF THE HEAD

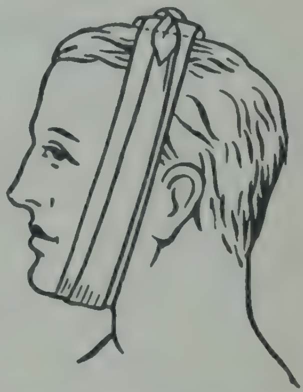


FIG. 19.—BANDAGE APPLIED TO THE TOP OF THE HEAD

of a wound at the back of the head, carry the bandage round the head horizontally, twist it over the forehead, and carry it round to the back again and tie it off over the pad (Fig. 18).

For a wound of the forehead, take similar action, placing the pad in front and twisting at the back of the head. When wound is at top of head, bandage as in Fig. 19.

(*e*) If the **skull is fractured** or if there is **glass in the wound**, apply a **ring-pad** so as to distribute pressure around, and not on, the wound. Bandage this pad on firmly (Fig. 12).

i) **Haemorrhage from the face** below the level of the eyes, and including the lips and outside of the nose, can be controlled by **pressure on the facial artery**

as it crosses the lower jaw (Fig. 20). It may be necessary to compress both facial arteries as the blood-vessels of the two sides of the face communicate freely: this applies particularly to **bleeding from the lips and cheeks.** Alternately, place the forefingers inside the mouth and the thumbs on the outside, on either side of the wound of the lip or cheek, and grip

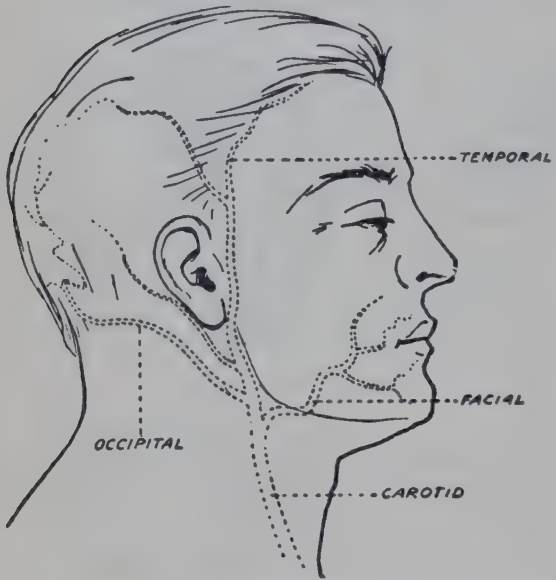


FIG. 20.—ARTERIES OF THE HEAD AND FACE

firmly the tissues between thumbs and fingers for a few minutes. Finally, apply a pad and bandage.

(iii) **Haemorrhage from a cut-throat wound**, involving the main vessels on one side of the neck, necessitates **immediate action**, as bleeding will be great from the jugular vein as well as from branches of the carotid artery.

(*a*) Apply **direct pressure with thumb** and pad to the wound; for example, wrap a handkerchief round the thumb.

(*b*) **Compress the carotid artery** by means of a thumb placed over it just below the Adam's apple.

Press backwards and inwards against the spine, care being taken not to press against the windpipe. To do this properly, stand in front of the patient and use the right thumb for pressure on the left carotid, and the left for the right carotid, while placing the fingers behind the neck (Fig. 16). **Never compress both carotids at once**, as this would lead to death of the brain cells within a few minutes.

(*c*) **Pressure must be maintained** until skilled medical aid is available.

2. UPPER LIMB HAEMORRHAGES

(i) **Haemorrhage from a finger** may be profuse, but it is readily controlled by direct pressure on the wound, aided by compression of the radial and ulnar arteries at the same time (Fig. 16).

(*a*) Control bleeding by **direct pressure** to wound.

(*b*) Apply a **dressing and bandage** (see page 105).

(*c*) Support with a **sling**, if necessary (see Fig. 46).

FIG. 21.—DIGITAL COMPRESSION FOR BLEEDING FROM THE PALM

) **Haemorrhage from the palm of the hand** may be very profuse, as the arteries of the palmar arch communicate freely with others and tend to be held open by the dense fibrous tissue in which they lie. If there is **no foreign body, such as glass**, in the wound, give first aid as follows:

(*a*) **Sit or lay** patient down.

(*b*) Press your left **thumb firmly into patient's palm** and your fingers on the back of the hand, and squeeze the palm between them (Fig. 21).

(c) **Raise patient's arm** as high as possible.

(d) **Apply a pad** or a 2-inch rolled bandage over th wound, which should be previously covered wit a dressing.

(e) **Bend patient's fingers** over the pad and te him to grasp it firmly.

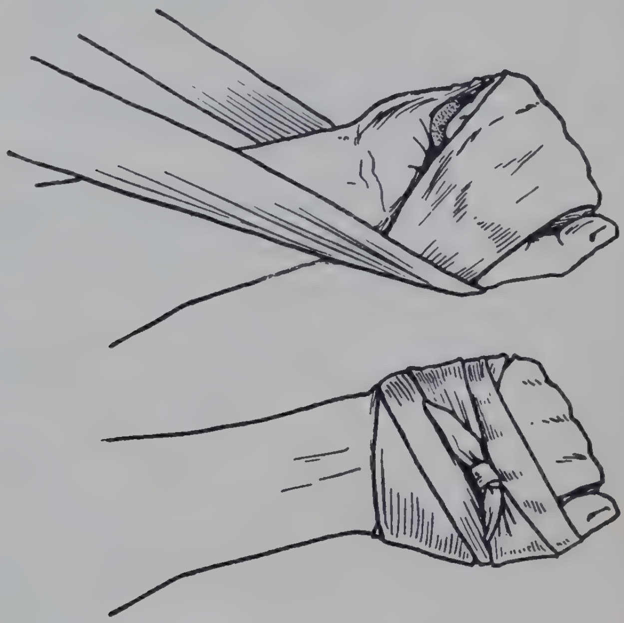


FIG. 22.—BANDAGING FOR WOUND IN PALM

(f) **Fix fingers tightly over the pad** by a narrow fold bandage. To do this, place the centre of th bandage over the knuckles of the clenched fis Next, carry the two ends over the front and bac of the patient's hand, and cross the ends roun the wrist. Then, take the bandage round th hand to bind fingers and thumb firmly, and ti ends in a reef-knot (Fig. 22).

(g) When a **foreign body**, like a piece of glass, is the wound, the bleeding may not be severe un this is removed. Even if the foreign body is larg it should not be removed by the first-aider, unle

it is loose. It should be remembered that there may be several smaller pieces in the wound. If there is severe bleeding, this is best controlled by digital compression of the brachial artery.

Haemorrhage from the forearm or upper arm should be dealt with on common lines.

(*a*) Lay patient down and **raise the arm**.

(*b*) Apply digital **pressure to the wound**, and

(*c*) **compress the brachial artery**: This is done by

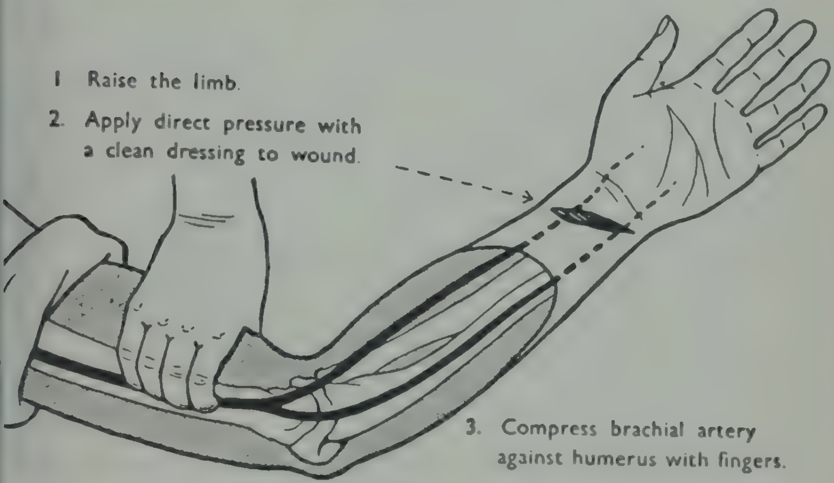
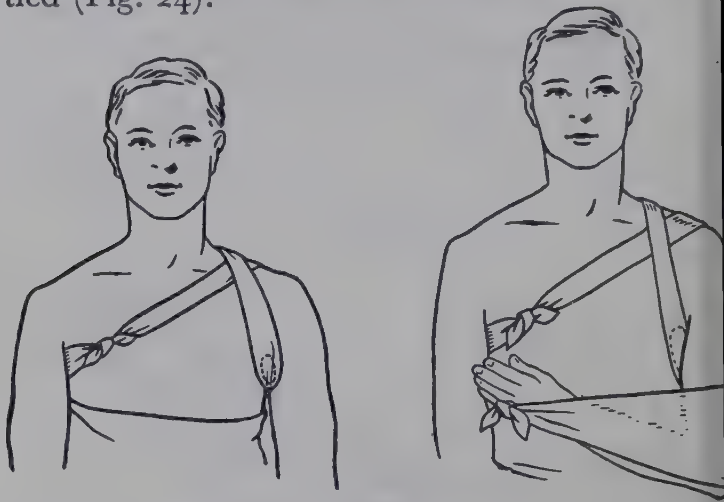


FIG. 23.—CONTROL OF BLEEDING FROM WOUND OF FOREARM

standing behind the raised arm, and passing your fingers down over the middle of the bicep muscle until the artery is felt pulsating beneath them. Then, with the thumb on the outer side of the arm, squeeze firmly while turning your hand in an outward and backward direction (Fig. 23).

(*d*) **Compression of the axillary artery** may be necessary if a fracture of the humerus prevents pressure being applied to the brachial. To do this, a large firm pad, such as a rolled-up 3-inch bandage, should be pushed as far up as possible into the armpit and fixed there by a narrow-fold

bandage, crossed on the shoulder, the ends bei
pulled tightly and tied off under the opposite ar
pit. The injured arm, bent at right angles at t
elbow, should be firmly held against the che
wall by a broad bandage. The bandages shou
all be outside the shirt or blouse; if not, the sk
must be protected by a dressing where knots a
tied (Fig. 24).



A B

Fig. 24.—Pad applied to compress Left Axillary Arte

A, First Stage B, Second Stage

Shirt has been omitted so as to show anatomical points

(*e*) **Compression of the subclavian artery** m
be done instead of applying a pad to the axillar
it is more effective, but is very tiring on the har
In a machinery accident in which the upper ar
has been badly injured, it may be the only ava
able method of applying first aid for the bleedir

To compress the left subclavian artery, pla
the patient in a sitting position and stand in fro
of his left shoulder. Now place your right thur
in the hollow immediately above and behind t
centre of his left collar-bone, resting the finge
around the back of the neck. Press the thur

downwards against the first rib, keeping your arm straight so that pressure is applied by the weight of your body and not by the muscle power of your arm, which is tiring (Fig. 16). To increase the pressure, apply your other thumb over the first.

To compress the right subclavian use your left thumb and stand in front of patient's right shoulder, and proceed as above.

3. LOWER LIMB HAEMORRHAGES

Haemorrhages from toes, feet, and lower legs most commonly result from cuts of the toes and the sole of the foot by treading on broken glass or sharp shells at the seaside, and are usually easy to control by direct pressure on the wound by means of pad and bandage. If this fails, then the choice of first aid treatment rests between compression of the popliteal artery by pad and flexion of the knee (Fig. 25) or of the femoral artery by digital pressure at the groin. **The technique for compressing the femoral artery** is as follows:

Fig. 25.—Compression of the Popliteal Artery

(*a*) **Lay the patient flat** on his back.

(*b*) **Kneel down** to the injured side of and **facing** the patient's feet.

(*c*) **Place your hands** so that the fingers of one hand are on the outer side of the groin and those of the other hand on the inner side of the groin, the thumbs being centrally placed.

(*d*) Place one **thumb on the middle of the groin,**

directly over the femoral artery, and rest the ot
thumb on top of the first.

(*e*) **Press the thumbs backwards** so as to compr the artery against the pelvic bone, keeping **arms straight and stiff** to maintain pressure the weight of the body rather than by muscu action, which is tiring (Fig. 26).

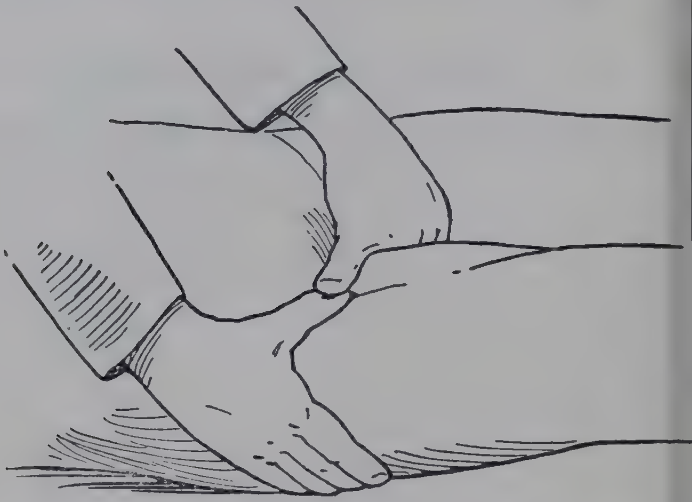


FIG. 26.—DIGITAL COMPRESSION OF THE RIGHT FEMORAL ARTE

(ii) **Varicose veins** may rupture through the skin a bleed profusely as a result of injury. First aid tre ment must be prompt, as described at page 28.

(iii) **Haemorrhages from the thigh** are liable to occ when the femoral artery is injured in compou fractures of the femur or by stab or bullet woun The bleeding is profuse and dangerous; it must controlled at once by compression of the femo artery in the groin, followed, if necessary, by t application of a tourniquet high up in the thi Strict attention must be paid to the method of apply a tourniquet and the need to loosen it every quar of an hour, as detailed at pages 31–33.

THE MAIN ARTERIAL PRESSURE POINTS

(See Figs. 14 and 16)

ARTERY	PRESSURE POINT AND ACTION
Occipital	Press with thumb over bony prominence just behind and below ear, four finger-breadths from earhole.
Temporal	Press with thumb on bony ridge just in front of earhole.
Facial	Press with thumb against lower jaw 1 inch in front of angle of that bone.
Carotid	Press with padded thumb inwards and backwards against spine, just below and behind the Adam's apple.
Subclavian	Press with both thumbs downwards on to first rib immediately behind middle of collar-bone.
Brachial	Roll the artery upwards under the biceps muscle and press it against the middle part of the humerus, using four fingers on inner and thumb on outer side of arm.
Palmar arch	Flex patient's fingers tightly over pad in palm.
Femoral	Press with both thumbs against the rim of pelvis in the middle of groin. Kneel and keep arms straight.

CHAPTER VI

INTERNAL HAEMORRHAGE

INTERNAL bleeding is serious as it often involves vit organs and is invisible, at least to begin with, and m reach a dangerous degree before the condition is recognise The haemorrhage may be into one of the body caviti (skull, chest, abdomen, or pelvis), into an organ (brai lung, stomach, or intestine), or into the tissues where forms a bruise. Later, some of the blood may be visib when it is coughed up in a frothy red form **(haemoptysi** from the lungs, vomited up **(haematemesis)** from th stomach, passed from the bowel as a tarry motic **(malaena)**, or voided in the urine **(haematuria)** whe the kidneys or bladder are involved. Internal haemorrha may result from blows, blast effects, bomb or bullet wound crushes, fracture of ribs or pelvis, stab wounds, or diseas Symptoms and signs of shock or collapse as outlined page 16 are suggestive of internal haemorrhage, partic larly if there is **an increasing pulse-rate, restlessnes air hunger, and dimness of vision**.

First aid treatment should be limited to preventi the condition from worsening.

(i) Lay the patient down with **legs raised.**
(ii) Keep him **quiet**.
(iii) **Maintain body heat** with blankets, rugs, or coats.
(iv) **Do not give him anything to drink or eat**, as th may be fatal in internal chest or abdominal condition and food may interfere with the giving of an anae thetic, if needed.
(v) **Do not apply hot-water bottles** or ice-bags chest or abdomen, as they do more harm than goo in most cases of internal haemorrhage.

vi) Get the patient to **hospital** as **quickly** and **gently** as possible.

The general first aid treatment for serious internal leedings having been given, it is necessary to consider the cal treatment of the commoner forms of internal haemor-age, such as: bleeding into the tissues **(bruises)**; nose eeding **(epistaxis)**; bleeding from the ear; mouth eeding from tongue or tooth sockets; bleeding into the ain **(cerebral haemorrhage)**; coughing up of blood om the lung **(haemoptysis)**; vomiting of blood from e stomach **(haematemesis)**; bleeding from the lower wel as in piles **(haemorrhoids)**; and passage of blood the urine **(haematuria)**.

BRUISE or CONTUSION

A fall or a blow with a blunt object damages small od-vessels (capillaries) in the skin and underlying sues, causing blood to ooze. This leads to local **swelling** d **discoloration**. The colour is due to the bleeding and bsequent breaking down of the blood-clot in the tissues: first it is red, then purple, and later greenish-yellow. A lack eye' is a good example of a bruise. Bruises are ed by nature in the course of two to three weeks, but lling can be limited and pain diminished by treatment.

st aid treatment

) Apply a **cold compress**, prepared as indicated on page 77. Cold promotes clotting of blood, which stops the bleeding and so limits the swelling.

) **Never use methylated spirit for a compress near the eye.**

) **Repeat the cold compress** two-hourly, if necessary.

) When compress treatment is finished, **firmly bandage** the part and **rest it**.

) **Bruises of the abdominal wall** are serious, as the blow received may have injured a vital organ. Such

cases must be treated for shock, and a doctor sum-moned at once.

NOSE BLEEDING or EPISTAXIS

Bleeding from the nose without any injury is no infrequent with some children: this is not serious and

FIG. 27.—TREATMENT OF NOSE BLEEDING

readily checked. In adults, epistaxis is usually the resu of some injury, such as a blow or nose picking: it may b a sign of a fractured skull. In older persons nose bleedin may be associated with high blood-pressure.

Provided there is no fracture of the skull, the **first ai treatment** is:

(i) Make patient **sit up** with head erect or bent slightl forward, so that the blood does not trickle down th throat.

(ii) **Loosen clothing at neck** to allow blood to retu to the heart.

(iii) Get patient to **pinch his nostrils firmly** for

minutes to compress the blood-vessel in the septum of the nose: this is the vessel which most frequently bleeds.

v) Apply a **cold compress** to the nose or place the patient near an open window to lessen congestion in the nose (Fig. 27).

v) Instruct patient **not to blow his nose** for some hours, but to sniff up gently and breathe through his mouth.

i) If bleeding continues, and in all instances with old people, call a **doctor** or send case to a hospital.

BLEEDING FROM EAR

Blood trickling from the ear may be a sign of fracture the base of the skull. The patient should be laid down d kept quiet, pending the arrival of a doctor. Medical d should be summoned at once. **Do not plug the ear**: nply apply a dry dressing over it, and lay the head with e bleeding ear downwards.

BLEEDING FROM TONGUE

Haemorrhage from the tongue may be caused by biting or by a cut from a broken clay pipe or by ulceration a cancer, when it is often severe. **First aid treatment** uld be as follows:

) **Sit patient up with head bent forward** enough to allow the blood to run out of the mouth.

) **Grasp the bleeding part** of the tongue between forefinger and thumb, maintaining firm pressure for 5 minutes. Relax the pressure, but reapply if bleeding recurs.

If the bleeding continues or is very profuse, **hook both index fingers over the tongue** as far back in the mouth as possible: then pull the tongue forward and compress it firmly against the inner side of the lower jaw.

(iv) If patient becomes unconscious from the haemorrhage turn him **face downwards** to prevent him drownin in his own blood, but still endeavour to arrest th bleeding.

(v) Send for a **doctor.**

BLEEDING FROM TOOTH SOCKET

After tooth extraction troublesome bleeding from th socket may occur immediately or within a few hour (reactionary bleeding). The **first aid treatment** is :

(i) **Rinse** out mouth with cold water.

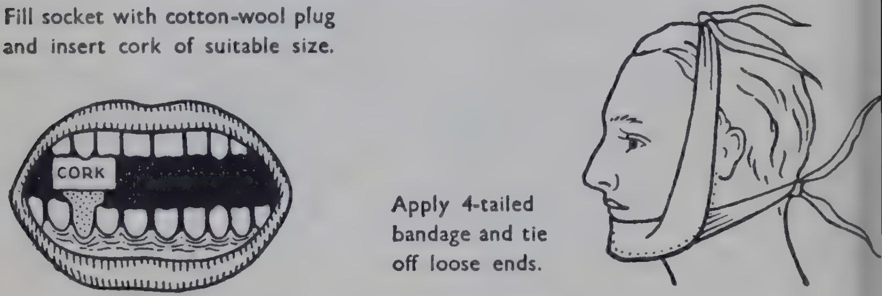


FIG. 28.—TO STOP BLEEDING FROM TOOTH SOCKET

(ii) Insert into the socket a fair-sized **wad of cotton-wool or lint.**

(iii) Place a **cork** over the wad and get patient to bite on it.

(iv) Apply a **four-tailed bandage** to the chin to help t maintain bite (Fig. 28).

(v) Send patient to **dentist or doctor**.

BRAIN or CEREBRAL HAEMORRHAGE

Bleeding into or on the surface of the brain is referre to as a **cerebral haemorrhage, apoplexy** or a **' stroke '** as the patient is often stricken suddenly with paralysis. I may be caused by injury to the skull when there is fracture or simply bruising of the brain, or by disease the arteries as in the elderly. In the latter case, the arter

alls lose their natural elasticity, become brittle and liable rupture under the strain of strong exertion or emotion. he brain, its membranes and fluid, practically fill the ull, so that even small bleedings inside the skull are able to compress the brain and seriously to interfere with s function.

The signs and symptoms may appear suddenly or adually, depending on the degree and site of the eeding.

The individual may suddenly fall down, or gradually become duller and duller mentally and have a severe headache. Later, unconsciousness develops.

The face is usually flushed — not pale as in a faint or shock.

One or more limbs may be limp, usually on one side only, and the mouth may be drawn to one side, or there may be twitchings.

Breathing is slow and noisy, and the pulse is slow and strong.

Note any signs or symptoms and report them to the doctor.

rst aid treatment

(i) Lay the patient **flat with head to one side** to allow saliva to drain out and to prevent the tongue from blocking the air-way. If necessary, press the angle of the lower jaw forward to keep the tongue from falling back.

ii) Remove any **false teeth**.

i) **Raise the head** slightly on a cushion or rolled-up coat.

v) **Loosen clothing** at neck and waist.

v) Keep patient **warm.**

i) **Give no fluids or food** while patient is unconscious.

ii) **Never give any alcohol.**

ii) **Send for a doctor** immediately.

COUGHING UP OF BLOOD or HAEMOPTYSIS

Bleeding from the lungs, whether due to wounds of th chest or to disease (*e.g.* tuberculosis), is manifested soone or later by the coughing up of bright-red (oxygenated blood if the bleeding is great, or of frothy, bright-red spittl in lesser haemorrhages. This is termed **haemoptysis** No matter what is the cause of the haemoptysis, the patien suffers much anxiety which makes the bleeding worse b increasing the rate of blood-flow. Prompt and tactfu first aid is therefore desirable.

Chest wounds may be due to stabbing or to missiles such as bullets or bomb fragments; and, though there is a surface wound with some bleeding, the greatest haemorrhage may be inside the chest. Crush injuries, as when people are run over by a car, or jammed between train buffers, or pinioned by a fallen tree or telegraph pole, may cause bleeding from the lungs as the result of ribs being broken and the sharp ends penetrating the lungs. Several pints of blood may escape into the chest as a result, without any spitting of blood. The condition can be recognised, however, by the signs and symptoms of internal haemorrhage (see page 27). It is wise to treat all cases of crushed chest as though there were internal haemorrhage.

First aid treatment

(i) **Lay patient down**, and turn him **on to his injured side** to lessen respiratory movements of the damaged part and to allow the sound lung to expand fully.

(ii) **Raise his legs**, and loosen clothes at neck and waist.

(iii) Keep him **quiet**.

(iv) **Maintain body heat** with blankets, rugs, or coats.

(v) **Do not give anything to drink or eat** as this may be fatal.

(vi) Apply a **clean dressing** to any wound to prevent air being sucked in.

(vii) Send for **doctor** or get patient to **hospital** as **quickly** and **gently** as possible.

VOMITING OF BLOOD or HAEMATEMESIS

The vomiting of blood is called **haematemesis**, and nay be due to wounds or disease of the stomach. The ommonest causes are ulcer and cancer of the stomach. If he bleeding is great, the vomit will consist of dark-red lood mixed with food particles; with smaller bleedings,

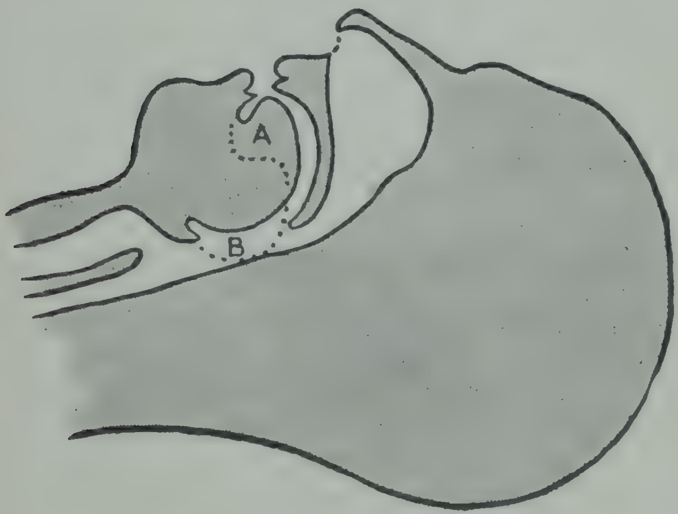


FIG. 29.—MAINTAINING A CLEAR AIR-WAY

Normal position of tongue B, Tongue drops backwards during unconsciousness

e vomit will have the appearance of coffee grounds, owing the blood being partly digested. There may be dominal pain but collapse is present in all cases, the gree depending on the nature of the injury and extent the bleeding.

Blood from a bleeding stomach is dark red or brown ut never frothy, whereas that from the lungs is bright red d frothy.

Some of the blood in a large haemorrhage from the omach will pass down the bowel and cause the motions be dark brown or even tarry. This is called ‘malaena’.

All cases of haematemesis are serious, whatever the cause may be, and must be treated at once on similar lines to bleeding from the lungs or any other internal bleeding (see page 54).

Note that the patient should be placed **flat on his back** with **head to one side**, so that vomit will not block the air-way (Fig. 29). **Do not give anything to eat or drink**, but send for a doctor immediately.

If there is an abdominal wound, expose it carefully, while keeping the patient well covered otherwise, and apply a clean dressing, fixing it in position by means of a roller towel, bolster slip, or some improvised broad bandage, which can be wrapped round the body.

BLEEDING FROM BOWEL

If the lower bowel is so injured or diseased that it bleeds, red blood will be passed either on or mixed with the motion. Blood derived from the stomach or upper bowel is partly digested before it is passed, so the motions are either dark brown or tarry **(melaena)**. Blood from distended veins **(piles or haemorrhoids)** in the back passage is bright red. All such cases should be referred to a doctor, and the only first aid needed is the application of a dressing to protect the underclothing.

BLOOD IN THE URINE or HAEMATURIA

The presence of blood in the urine is termed **haematuria.** This may be due to injury or disease of any part of the urinary tract, and most commonly arises from the kidneys or bladder. The kidneys may be injured by stab or missile wounds, or by crushes. The bladder is frequently torn when the pelvis is fractured as when a person is run over. There is usually considerable pain. If the bleeding is small in amount it makes the urine a smoky colour, but, if there is much blood, the urine has a port wine appearance.

First aid treatment

(i) **Lay patient down** and keep him **quiet**.
(ii) **Keep him warm** as for all internal bleedings.
(iii) Tell him **not to pass urine**: if any is passed, keep it to show the doctor.
(iv) Send for a **doctor** or transfer on **stretcher to hospital**.

CHAPTER VII

THE RESPIRATORY SYSTEM AND ARTIFICIAL RESPIRATION

FAILURE of breathing, like severe arterial haemorrhage, is a condition requiring immediate first aid. To apply this intelligently and with the best results, it is necessary to have some knowledge of the structure and function of the respiratory system.

ANATOMY AND PHYSIOLOGY

The respiratory system consists of the nose, throat **(pharynx)**, voice-box **(larynx)** which is inside the Adam's apple, windpipe **(trachea)** which divides into two main air-tubes, the right **bronchus** and left **bronchus**, leading to the air-sacs or **lungs**. The lungs are two sponge-like organs, which occupy most of the chest, lying one on either side of the heart: below they rest on top of the large muscle **(diaphragm)** which divides the chest from the abdomen (Fig. 30). Each lung is covered by a fine, transparent membrane (the **pleura**), which also covers the inner side of the chest-wall and permits the lungs to expand and contract without friction during normal breathing. Inflammation of this membrane is called **pleurisy**, and this interferes with the breathing, as the surface of the pleura becomes roughened, causing friction and pain with every full movement of the lungs.

Breathing or respiration. The function of the respiratory system is to supply oxygen to the blood and give off carbon dioxide gas, which is one of the waste products of the body. This function is called **respiration**, and the act consists of three phases — first, expansion of

he chest-wall and lungs leading to drawing in of air **inspiration)**; then return of the chest-wall and lungs to neir position of rest **(expiration)**; followed by a slight ause (Fig. 31). A healthy person at rest takes 15 to 18 reaths a minute: this rate is increased with exercise. Moreover a woman breathes a little faster than a man, nd her breathing is mainly by chest movements **(thoracic**

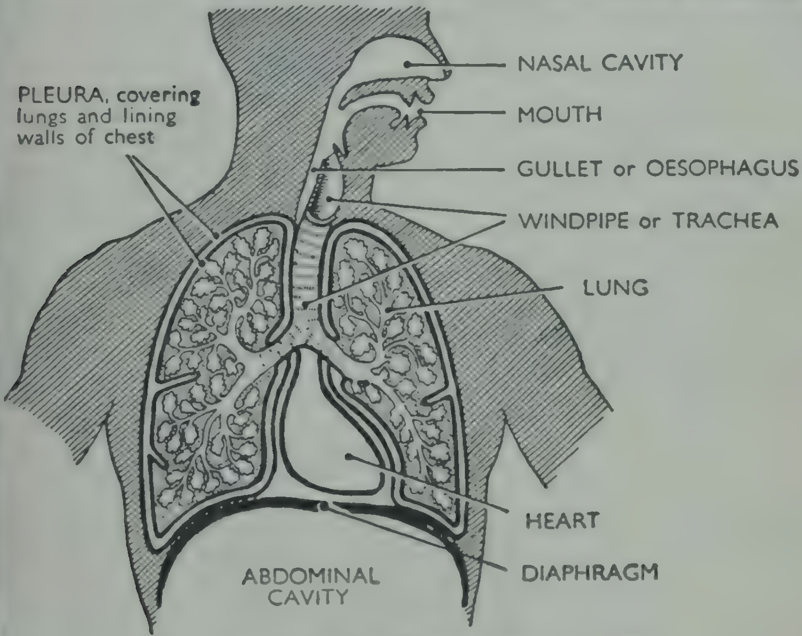


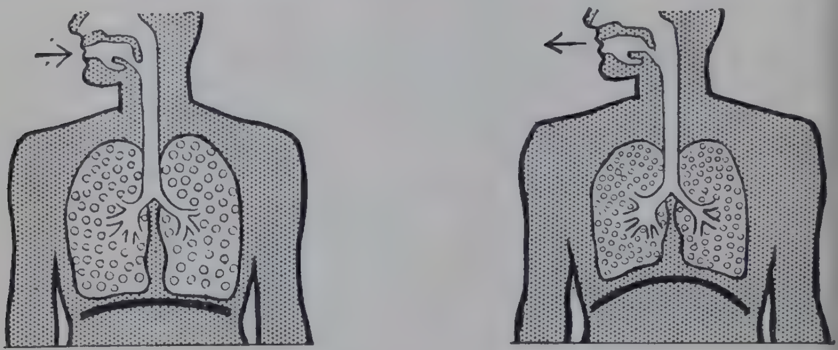
Fig. 30.—The Air-Passages and Lungs

eathing), whereas a man's breathing is more **abdominal**.

Air enters normally through the nose (or mouth in outh breathers), which is furnished with hairs to remove oss particles, and is very rich in blood-vessels to help to rm the cold incoming air and thus prevent chilling of : windpipe and lungs. At the back of the throat the enters the voice-box or larynx, which is guarded by a -like structure **(epiglottis)**. This lid closes the voice-x whenever the person swallows either fluid or solids so to prevent choking. If a person is insensible, however, s reflex movement of the epiglottis does not take place,

so that anything given to be swallowed or matter vomited would cause choking **(suffocation)**. Moreover, in an insensible state, the tongue is liable to fall back and obstruct the air-way. To prevent such an accident, unconscious patients should have their heads turned to one side.

From the larynx, the air passes down the windpipe (about 6 inches in length) and several inches of bronchial tubes, where it is further warmed, before reaching the **lungs**



Inspiration Expiration

FIG. 31.—DIAGRAMMATIC REPRESENTATION OF RESPIRATION

alveoli. In the alveoli the air is separated from the blood capillaries merely by a very thin layer of cells. Here oxygen is taken into the blood of the capillaries, and carbon dioxide is given off before the blood returns to the heart (see page 14).

SUFFOCATION or ASPHYXIA

If fresh air is prevented from entering the lungs, suffocation or **asphyxia** will result from the want of oxygen. In this connection it is important to remember that the cells of the body, particularly those of the brain, cannot live for more than a few minutes, if completely deprived of oxygen. Moreover, in the brain there are the vital nerve centres which govern the respiration and circulation. The urgency of removing the cause of suffocation and applying artificial respiration will therefore be appreciated.

The chief **causes of asphyxia** are:

1. **Choking** or blocking of the opening to the windpipe.

2. **Smothering**, whereby air is prevented from entering the body either by—
   (i) **Solids** such as **cushions or bedclothes.**
   (ii) **Fluids** as in **drowning**.
   (iii) **Gases** or fumes which displace air — *e.g.* **coal-gas poisoning.**

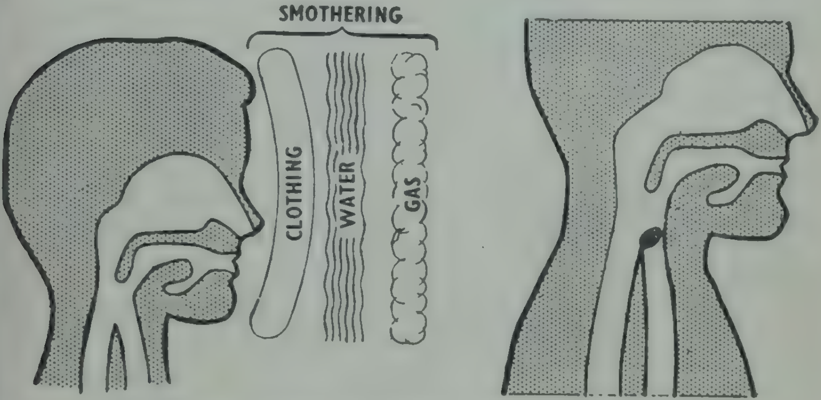


FIG. 32.—CAUSES OF SUFFOCATION OR ASPHYXIA
A, Smothering B, Choking

3. **Strangulation** or constriction of the neck as in throttling or hanging.

Fixation of the chest-wall as in crushes in dense crowds or by falls of earth interfering with the expansion of the lungs.

Paralysis of the muscles of breathing as occurs through damage to the respiratory centre in the brain by electric shock or lightning stroke.

Breathing rarefied air which is deficient in oxygen as in mountain-climbing or high-altitude flying (Fig. 32).

The **signs and symptoms** are: increasing blueness face and hands, puffiness of face and neck, congestion of eins, swollen lips, protruding eyeballs, followed by nconsciousness and death if not treated promptly. If the uffocation is incomplete, the main symptoms will be oughing, spluttering, and forced, noisy breathing. The

mouth and nose are filled with white frothy fluid in case of drowning, and there may be pinkish froth in cases o carbon monoxide gas poisoning.

1. **Choking** or obstruction of the windpipe is most com monly seen in children in whom a sweet, marble, or buttor may be the cause of the trouble. In adults, a piece of foo may go down the wrong way, or, in unconscious or semi conscious people, false teeth may become displaced, or the tongue may fall back. If food gets into the opening to the windpipe, it causes a severe bout of coughing, which usually displaces the fragment that has taken 'the wrong turning'. Should the obstruction persist:

FIG. 33.—FIRST AID TREATMENT FOR CHOKING

(i) Get the patient to **bend his head and shoulders** well forward and downwards.
(ii) Then, give him a good **thump** with the flat of your hand **between the shoulder-blades** (Fig. 33).
(iii) If this fails to dislodge the obstruction, hook it out with your forefinger curled down towards the root of the tongue, or make the patient retch and **vomit by tickling** the back of the throat with your finger.
(iv) If still unsuccessful, get a **doctor immediately**.
(v) In the case of a **small child**, hold him **upside down** and slap him hard on the back.

2. **Smothering** may result from cushions or bedclothes accidentally obstructing the nose and mouth, or from criminal assaults as in gagging with scarves, stockings, etc. First aid consists in removing the cause, applying artificial respiration if necessary, and treating for shock.

3. **Drowning** is caused by complete immersion of the nose and mouth in water (or other fluid) for a length of time which varies with the individual and circumstances. Unless

ıe drowning is due to a person having fallen unconscious ıto a shallow puddle of water, the submersion causes ater to enter the windpipe and lungs, so that this must e drained out before artificial respiration can be effective. ı every case of drowning, the first-aider should apply tificial respiration, for the heart's action continues for me time after breathing has ceased, and breathing may

FIG. 34.—DRAINING WATER FROM THE AIR-PASSAGES

started again even after an hour or more of artificial piration.

If one person is alone he must confine his attention to patient, but if others are available they should get a ctor as quickly as possible, and fetch blankets, rugs, hot-ter bottles, hot tea, and a suitable conveyance.

(i) **Do not lose an instant**: act quickly and methodically.
ii) **Turn the casualty face down** with head to one side and arms stretched beyond head; if there is a slope, place head lowermost.
ii) Raise the body by placing your hands round the casualty's belly to **encourage the water to run out** of the air-passages (Fig. 34).

(iv) Quickly **clear the mouth** of any false teeth or weed and loosen any clothing around neck and waist.

(v) Apply Schafer's method of **artificial respiratio** until breathing is restored, imitating the rhythm c normal breathing (see page 67). **Never sto artificial respiration** until breathing has bee re-established for at least a quarter of an hour c until a doctor pronounces life to be extinct. Go o for two hours or more, if necessary.

(vi) For **prolonged artificial respiration Eve' method** (see page 70) may be adopted if facilitie exist, but to begin with, and generally, Schafer's i the method of choice for the first-aider.

(vii) If assistance is available, **wet clothing** may b removed and dry clothing or blankets substituted but this must not interfere with artificial respiration In addition, an assistant can improve the circulatior by gently rubbing limbs from below upwards.

(viii) Keep the body as **warm as possible** with blanket and protected hot-water bottles to treat the shock which is always present as a result of the fright struggling in and chilling by the water.

(ix) When consciousness returns, give **hot drinks**.

(x) **Do not let the patient sit up**, even after apparent recovery.

(xi) Carry as a **stretcher case** to a near-by house, and put him to bed.

(xii) Transfer patient to the care of a **doctor** or hospital as soon as possible.

4. **Suffocation by gases** is relatively common both in peace and war. The main gases concerned are carbon monoxide, carbon dioxide, chlorine, nitrous compounds, and prussic acid. The commonest of these is **carbon monoxide**, which is odourless, colourless, and very dangerous. Carbon monoxide is a constituent of coal ga as used in the home and is frequently used by suicides. I is present in motor-car exhaust gases and will cause

phyxia in a few minutes if a motor engine is run in a osed garage. It is also found in the smoke of charcoal, al, and coke fires, and is apt to cause gassing of those ho sit over such fires, especially in badly ventilated places - for example, night watchmen. Miners are exposed to rbon monoxide poisoning (choke damp). Carbon monide is often present in deadly amounts in the smoke from urning buildings, and the fumes in holes made by explodg bombs, mines, or shells. **Carbon dioxide** may cause colpse in those working in vats in breweries, or in deep wells sewers. Firemen may suffer from the effects of smoke ving to its high carbon monoxide and dioxide content.

Most of these gases cause their ill-effects by displacing r in the lungs, so depriving the body of its oxygen supply: rbon monoxide also decreases the oxygen-carrying wer of the blood. The first aid treatment is, therefore, remove the person from the cause, apply artificial spiration, and give oxygen if available. Some gases ch as chlorine and nitrous fumes, as used in chemical arfare, also damage the lung substance: here artificial spiration would tend to damage the lung further, the first aid treatment is limited to giving oxygen d keeping the patient warm. Other gases like prussic id, as may be used for killing vermin in buildings and ps, act mainly by paralysing the respiratory centre in brain and death is usually instantaneous. The first treatment is to give artificial respiration and oxygen.[1]

The rescue of gas casualties is fraught with great nger. The Civil Defence or Service gas respirator affords protection against the commonest gas with which you likely to have to deal, namely, carbon monoxide. In nes and similar places where this type of gas poisoning ikely to occur, oxygen-breathing apparatus is usually ilable for rescue work. Failing this, apparatus can be provised by attaching a length of hose-piping to the epiece of an ordinary respirator and leaving the end of

[1] This should preferably be pure oxygen rather than oxygen with bon dioxide.

the pipe in the fresh air. A wet handkerchief placed ov the nose and mouth only protects against irritation of t smoke and gives no protection whatsoever against t carbon monoxide which is always present with fires a after explosions. In the case of a room filled with smok if no other means of protection are available, you should-

(i) Place a **wet handkerchief** across your nose a mouth.
(ii) Take two or three **very deep breaths**, and ho your breath as long as possible.
(iii) **Crawl along the floor** of the room where the co centration of any gas is likely to be least, as gas tend to rise.
(iv) Quickly **open a window** or break some of the pane
(v) Seize the affected person and remove him as quickl as possible to the **fresh air**.
(vi) **Loosen his clothes** at neck and waist, and perfor **artificial respiration**.
(vii) Treat for **shock.**

5. **Strangulation** is usually the result of hanging, c throttling by hands or a rope, scarf, or stocking being tie so tightly round the neck as to constrict the windpipe.

In cases of **hanging**:

(i) Immediately grasp the person round the legs and lif to take the **weight of the body off the rope**.
(ii) **Shout for help.**
(iii) With or without help, **cut the rope** or loosen it fron the neck.
(iv) Perform **artificial respiration.**

In other types of strangulation, remove the constrictin force from the neck and apply artificial respiration.

6. **Fixation of the chest-wall** most commonly occurs i accidental burials by falls of earth, coal, or grain, or b crushing in dense crowds, or by being pinioned under falling tree or telegraph pole. The force applied to th chest must be removed as quickly as possible, usin

hatever material is available for props (poles, planks, etc.). rtificial respiration must be applied immediately.

. **Electric shock and lightning stroke** have been dealt ith at pages 21–23.

. **Asphyxia in rarefied atmospheres**, as in flying at ltitudes over 10,000 feet or mountain-climbing, must be eated either by quick descent to lower levels or by inhaling xygen.

ARTIFICIAL RESPIRATION

Artificial respiration is used to make a person whose atural breathing has stopped, start breathing again. It ust be done deliberately and regularly for at least an our, if the patient does not recover before then. Resuscita-on as a result of artificial respiration may occur many ours after apparent death.

While artificial respiration is being applied, an assistant ould loosen clothing at neck and waist of the patient, ake sure that there is nothing in the mouth blocking the rway, get clothing or rugs to keep the patient warm, and assage the limbs from below upwards. This assistance ust not interfere with the application of artificial respira-on, which is all-important.

1. SCHAFER'S METHOD (Figs. 35, 36, and 37)

(i) Lay the casualty **face downwards** with head turned to one side and arms stretched up beyond the head.

ii) Make sure that the **mouth and nose are not obstructed**.

i) **Kneel to one side** of the casualty's hips, facing his head.

v) Place your **hands flat in the small of the back**, over the lower ribs and just above the top of the pelvic bone. Your thumbs should almost touch each other in the middle line, the fingers being over the loins (Fig. 35).

v) **Sit on your heels**, no weight being transmitted to

FIG. 35.—POSITION OF HANDS FOR ARTIFICIAL RESPIRATION (SCHAFER'S METHOD)

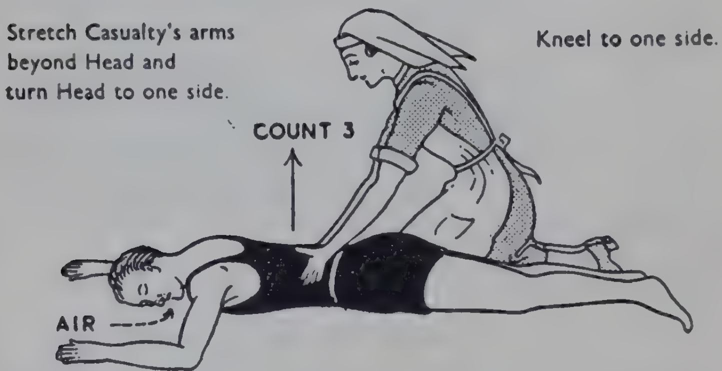


FIG. 36.—ARTIFICIAL RESPIRATION (SCHAFER'S METHOD)

Position 1: Inspiration

Arms should be straight with hands on small of back, thumbs almost touching each other. Place no pressure on patient. Count 3 seconds, then swing slowly forwards from the knees to Position 2, keeping the *arms straight and hands in place all the time*

the casualty, though your hands are maintained on his back (Fig. 36).

vi) Swing your body slowly **forward from the knees keeping your** arms straight and hands in place all the time, so that a steady pressure is transmitted by the weight of your body. Maintain this position for 2 seconds. This action presses the casualty's abdomen against the ground, forcing his abdominal contents up against the diaphragm, which is raised and expels some air out of the lungs — expiration (Fig. 37).

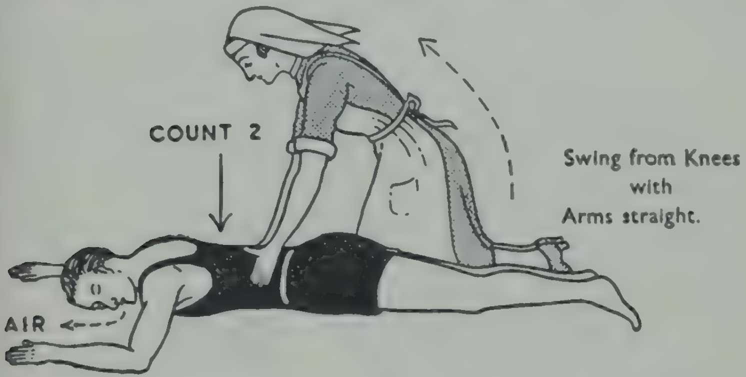


FIG. 37.—ARTIFICIAL RESPIRATION (SCHAFER'S METHOD)

Position 2: Expiration

r weight without extra exertion should bear down on patient for 2 seconds before
king to 1st position. Repeat this action of the inspiration and expiration regularly
natural breathing returns, *then keep patient flat and warm till transferred to care of doctor*

i) Keeping your hands in position and arms straight, **relax the pressure by swinging gently and steadily back** on to your heels, counting 3 seconds before swinging forwards again, as at (vi). This allows air to enter the lungs — inspiration (Fig. 36).

These swaying to-and-fro movements must be repeated ularly at a rate of 12 to 15 a minute, and it is an aid count and act as follows:

(1) swing forwards; (4) swing backwards;
(2) apply pressure; (5) rest on heels;
(3) release pressure;

and continue this, if necessary, by relays of helpers, unt natural breathing begins. Even then, artificial respiratio should be continued for another quarter of an hour, an the case should be carefully watched for some hours afte to ensure that the breathing does not stop again. If i

FIG. 38.—EVE'S METHOD

Artificial respiration is being done while the suffocated man is being fixed to the stretcher

does stop, artificial respiration must be recommenced at once.

When apparent recovery has taken place, the casualty should be placed on his side in a warm bed, given a hot drink, and encouraged to sleep. The patient should not be allowed to sit up until the doctor says so.

2. EVE'S METHOD (FIGS. 38 AND 39)

The Schafer method of artificial respiration is the first-aider's standby, as it is efficient and can be carried out

ractically anywhere by one person. It is tiring, however, nd needs to be practised by trained persons. Eve's method particularly useful for prolonged treatment, being very asy to operate, even by a novice, once the rocking device as been rigged. The rigging is the difficulty — the asualty has to be laid face downwards with head turned one side on an ordinary or improvised stretcher, and

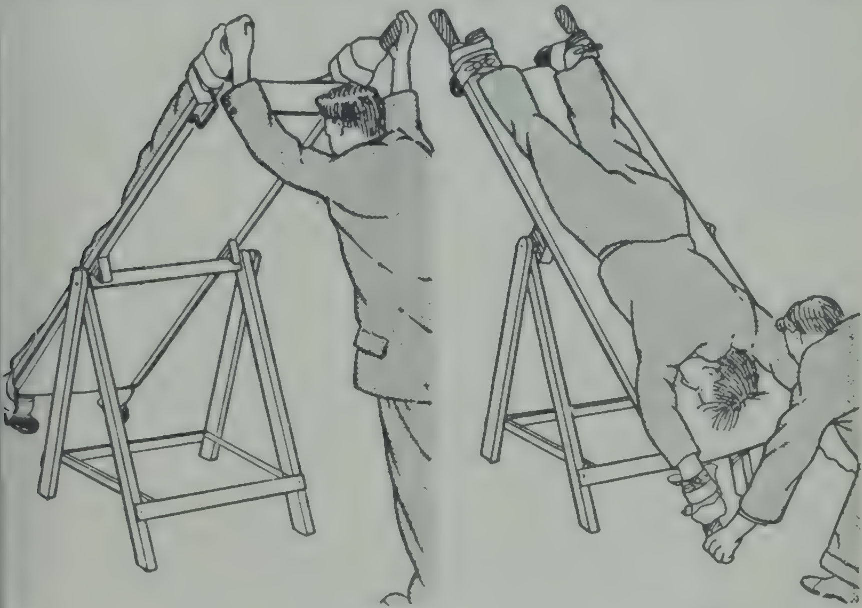


FIG. 39.—EVE'S METHOD OF ARTIFICIAL RESPIRATION

Rocking with a trestle as a pivot

ed to it with arms extended well beyond the head, while hafer's method is continued by someone else. Wrists d ankles must be well protected by a good layer of dding of some sort before they are bandaged to the ndles of the stretcher or to suitable parts of the impro- ed stretcher (Fig. 38).

A gate or a door removed from its hinges, a car seat, a ank, or a short ladder can be used as a stretcher. Next, e stretcher has to be placed across some support about feet above the ground, such as a suspended rope, a metal

bar, a wooden pole, a gate, or two ordinary chairs standi
back to back. Then rocking should be carried out at
rate of 12 complete rocks a minute — that is, tilting
the head and feet ends alternately through an angle
45 degrees each way. If two chairs are used as support
the tilting of the stretcher till it almost touches the seat
the chair will be about 45 degrees. To facilitate the pr
cess of rocking, two large nails can be hammered into eac
side of the stretcher at the point where it should pivot o
its support. At first aid posts, it is an advantage to fit on
stretcher with blocks suitable for use with a rope or trestl
(Fig. 39). Rocking can be done for hours even by untraine
persons.

CHAPTER VIII

MEDICAMENTS, DRESSINGS, APPLIANCES, AND BANDAGES

EFORE dealing with wounds, it is necessary to study and actise the preparation and application of medicaments, essings, and bandages as commonly used in first aid ork, whether in the home, office, workshop, field, or on e highway or beach.

The aims of first aid treatment of wounds are to prevent y further contamination and to stop bleeding. It is sential, therefore, to have clean hands, to apply sterile essings, and to avoid handling the wound or that part the dressing which is to come in actual contact with the ound.

The materials necessary in first aid are simple and few: eir range and quantity vary with the nature of the work ely to be done. The contents of the first aid haversack highway and field work are listed at Appendix A, and se suitable for a first aid box or cupboard in the factory home are shown at Appendix B. First aid haversacks, es, and cupboards should be clearly marked with a cross on a white background.

Under the Factories Act (1937), it is required that each t aid box or cupboard shall be placed under the charge a responsible person trained in first aid treatment, ferably someone holding a First Aid Certificate. This son's services must be readily available during working irs, and he should head any non-certificated first-aiders the particular department. Moreover, he should be ponsible for the first aid box being kept in good order d replenished after use.

MEDICAMENTS

For ease of reference these will be dealt with in alphabetical order.

1. **Castor oil** should be kept in a drop-bottle. It is used when eye drops are needed to soothe an eye which contains or has recently contained a foreign body.

2. **Collodion** is best supplied in a squeeze tube to prevent it becoming contaminated. It can be used to cover any small wounds and bites.

3. **Cresol types** of disinfectants (dettol, izal, lysol, sanolin, etc.) are used in strengths of 1 in 20 or 1 in 40 for sterilising hands and certain instruments, also for disinfecting bedpans, urine bottles, sputum mugs, etc., in which it should be left to act for at least an hour.

To make a pint of cresol solution (strength 1 in 40), take a one-pint jug and clean it thoroughly. Put a tablespoonful of the pure cresol compound into it, fill the jug with boiling water, and mix thoroughly. Cold water can be used, if necessary. To make a 1 in 20 solution, use two tablespoonfuls of disinfectant.

Alternatively, the solution can be made in a graduated measuring glass, if one is available.

All bottles containing disinfectant solution must be labelled ' Poison '.

4. **Euflavine** is an excellent non-irritant antiseptic, which can even be used in dilute solution for injecting into veins. It is supplied for first aid work in bottles containing 25 tablets. It is usually used in the treatment of wounds in a strength of 1 in 1000, that is, one tablet dissolved in a cupful of boiling water.

5. **Methylated spirit** is used mainly in making cold compresses (see page 77).

6. **Milk of magnesia** is given as a drink in cases of poisoning with acids, the usual dosage being two tablespoonfuls to a tumblerful of water.

Potassium permanganate is used in cases of poisoning r phosphorus or by narcotics, such as opium, morphine, loral, dial, luminal, and veronal. The dosage is a teaoonful of potassium permanganate crystals dissolved in tumblerful of water. Such a solution may be used to the a snake- or a dog-bite.

Sal volatile (aromatic spirit of ammonia) is used as a ld stimulant in cases of fainting. It is used either in the m of smelling-salts applied to the nostrils, or it may be allowed in the strength of a teaspoonful to a tumblerful water.

Salt (common salt or sodium chloride) is useful in st aid

) as a means of inducing vomiting (an **emetic**) in cases of poisoning, when two tablespoonfuls of salt are added to a tumblerful of water;

) to replace the body salts lost as the result of much sweating caused by excessive heat, as in cases of heat-stroke, when salted water should be given to drink (a saltspoonful of salt to a tumblerful of water);

) as normal saline (a teaspoonful of salt to a pint of boiling water) for use as a bland dressing for burns or to wash wounds, but only under the doctor's direction.

Sodium bicarbonate or baking soda is used as a mild aline dressing for acid burns and all insect stings, other n those due to wasps. It is prepared by dissolving a poonful of the soda in a tumblerful of boiling water.

Vaseline is used to smear around eyelids and mouth ases of burns of the face.

Vinegar, either pure or diluted, is useful for soothing asp sting.

DRESSINGS

Dressings are used to prevent wounds becoming coninated, to help to stop bleeding, and to absorb

discharges. It is essential, therefore, that they should b
sterile and absorbing. By '**sterile**' is meant that an
germs which were present in the material have bee
destroyed. In the case of dressings this sterilisation
attained either by dry or moist heat. For first aid wor
sterile dressings are usually obtained from the maker
enclosed in a sealed, germ-proof packet. Dressings are o
two main types — dry and wet.

1. **Dry dressings**

(i) **Adhesive** wound dressings may be applied either a convenient lengths cut from a spool of medicated adhesive plaster or as special dressings consisting of a medicated centre of boracic acid, fixed all round with adhesive plaster, which is kept fresh and sterile by a stout gauze covering. These can be obtained in two shapes, rectangular or circular: the latter is preferable, and $1\frac{1}{2}$-inch diameter is a convenient size. Adhesive dressings should only be applied to small, clean wounds.

(ii) **Burn dressings** consist of large pads of gauze impregnated with acriflavine very similar in design but larger than the field type. See item (iv) below.

(iii) **Cotton-wool** is mainly used over gauze dressings to absorb blood or discharge and to protect the part. It is also used for padding of splints, etc. Cotton-wool should never be applied directly to a wound, as particles will separate and get into the wound.

(iv) The **field dressing** is most useful in first aid work. It consists of an outer cover on which instructions for its use are printed; inside are two dressings each contained in a waterproof cover. The dressing consists of a pad of antiseptic gauze attached to a bandage in such a way that it can be applied to the wound without the fingers touching either the wound or the part of the dressing which will come in contact with the wound.

v) **Gauze** is the commonest form of dressing used for wounds in general. It is usually supplied in sterilised squares of 4 to 6 inches.

i) **Lint**, either plain white or boracic impregnated (pink), may be used for wet dressings and foments. Note that a wet dressing should not be applied in first aid work unless under the doctor's instruction, as moisture and warmth favour the growth and spread of germs.

Wet dressings

i) **Antiseptic dressings** can be made by soaking any clean material like gauze, lint, or a handkerchief, for a few minutes in an antiseptic lotion such as euflavine (see page 74). These should be wrung out as dry as possible before application, then covered with cotton-wool and fixed with a bandage. Remember that a dry wound heals quickest, so dry dressings are preferable to wet. The wet antiseptic dressing is only justified in first aid work when the sterility of the dressing material is in doubt.

) **Cold compresses** are useful in limiting bleeding and swelling in cases of bruising and sprains. To make a cold compress, take a thin towel, piece of lint, flannel, cotton-wool, or a handkerchief, and soak it in cold water. Squeeze out the water, so that the material does not drip when held up, but do not squeeze it dry. Place it on the part. Do not cover it up, but add a little water every half-hour, by dripping more on from a sponge.

The addition of a tablespoonful of methylated spirit to a tumblerful of water will make a better cold compress, as there will be more evaporation.

As evaporation is required, a cold dressing **must not be covered or bandaged on**.

Do not apply a cold compress to the lower limbs of elderly people in cold weather, as this may induce circulatory failure of the part.

(iii) **Hot fomentations** should only be applied on doctor's instructions. To make a hot fomentatio take a basin, a large piece of flannel, a thin tow and a kettle of boiling water. Place the towel acr the basin. Fold the flannel (or boracic lint) into fo layers, so that when folded it is fully large enough cover the part which is to be fomented. Pour th boiling water directly from the kettle o. to the flann until it is well soaked. Grasp each end of the tow and fold it over so that the flannel is hidden in i Then twist each end in opposite directions, until th water is squeezed completely out of the flanne Unfold the towel quickly, shake out the steam, an place the fomentation on the part. Cover it wit wool, so that the covering is 2 inches larger all roun than the fomentation. If wool is not available, cove the fomentation with a folded bath towel. Fix in plac with a suitable bandage.

It is important that the fomentation should b squeezed nearly dry before application, **as it ma scald if put on wet**.

APPLIANCES

1. **A steriliser** can be improvised by using a clean sauce pan or fish kettle. When instruments or dressings ar boiled in a steriliser, the latter should contain water withou any antiseptic. The water should be brought to boiling point before the instruments are put in, and they should b left in for 20 minutes — in emergency, the time can b reduced to 5 minutes. By using boiling water the risk o instruments rusting is reduced, as the boiling drives of the air which is the cause of the rusting. Sharp instrument such as knives should have their blades wrapped in a piec of lint or gauze to protect them against damage from othe instruments.

2. **An ice-bag** consists of a thin rubber container with screw-cap stopper. If not available, a waterproof spong

ag is a good substitute. Ice is crushed and placed in the ag and a teaspoonful of common salt is added to delay ielting. The bag is half filled with the ice, and as much ir expelled as possible before the stopper is replaced. For pplication it is covered with a piece of lint or a handker- iief. When the ice melts the bag must be refilled.

The usefulness of ice-bags in first aid work is very mited, their possible use being to help arrest internal aemorrhages when they may do even more harm than ood. Moreover, it is often difficult to obtain ice in this untry.

Hot-water bottles may be of rubber, stone, or ietal. Rubber bottles should be half filled with water at is not quite boiling, the air expelled, and the stopper serted. Stone and metal bottles should be completely led with nearly boiling water. The bottle should then dried, tested for leaks, covered, and have at least one yer of clothing or a blanket between it and the patient.

Splints are mainly used for the treatment of fractures, e most useful type being either wooden or wire, 11 inches ng with metal connections, so signed that several splints can joined together to make one the required length for the rticular case. As these are often available, splints can be im- ovised from walking-sticks, ibrellas, broom-handles, pieces wood, cardboard, folded news- pers, or from guns or rifles.

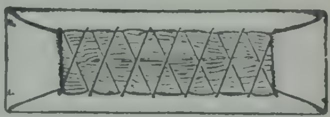


Fig. 40.—Back of a Splint, showing Method of Sewing the Linen over Splint and Padding

All splints must be well padded to prevent them maging the skin or pressing on nerves or blood-vessels. dding can be of any soft material, such as wool, tow, aw, hay, rags, or rushes. This padding should be fixed the splint by bandaging. There is rarely time in first aid rk to prepare a padded splint as shown in Fig. 40.

5. **Cradles** are used to take weight of blankets and othe[r] coverings from the site of injury. These can be impro-

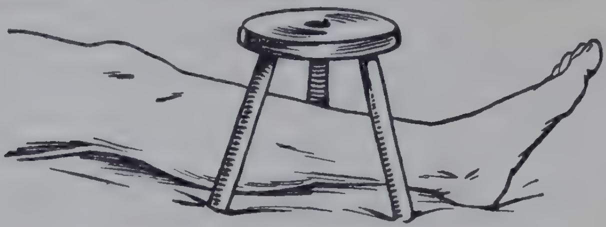


FIG. 41.—IMPROVISED CRADLE

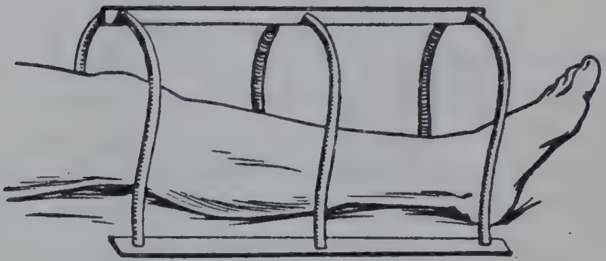


FIG. 42.—PREPARED CRADLE

vised from a stool or a large cardboard box (Fig. 41). In hospitals and large first aid posts prepared cradles are used (Fig. 42).

BANDAGES

Bandages are used to fix dressings and splints, to apply pressure over wounds or to blood-vessels (tourniquet), to lessen or arrest bleeding, and to support injured parts either in the form of slings or binders.

There are two main types of bandages, **triangular** and **roller**. In their absence, bandages may be **improvised** from belts, braces, handkerchiefs, neckties, scarves, straps, or strips of linen or calico, and, to fix splints, tape or cord may be used.

Tying. A bandage should always be tied in a **reef-knot**, as this does not slip and is more easily undone than a granny-knot. The difference between the two types of knot is shown at Fig. 43. It will be noted that the ends of

reef-knot lie parallel to the bandage and are readily icked away.

To tie a reef-knot, carry the end of the bandage that is the left hand over and around that in the right and ghten, then carry the end in the right hand over and round that in the left and tighten again. Briefly, the ing movements are —

left hand over right, tighten;
right hand over left, tighten.

his must be practised, first with string and later with a ındage, until this method of tying becomes automatic.

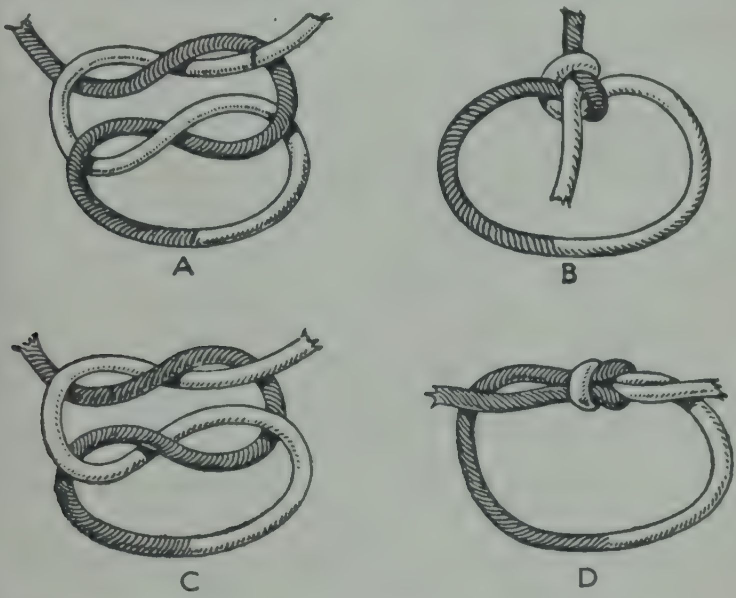


Fig. 43.—A, B, Granny-Knot: C, D, Reef-Knot

The position of knots is important. A knot should placed so that it does not press on a bone (*e.g.* collar-ıe) or chafe with movements as would occur at the k of the neck. A pad of lint or cotton-wool placed under knot eases pressure.

Unless bandages are applied firmly enough they are less, as the dressings or splints will slip out of place or

the bleeding will not be controlled. On the other hand
if bandages are applied too tightly, they may seriousl
impede the circulation or injure the part.

The free ends of bandages should be tucked out of sight
In some of the diagrams in this book the ends are show
protruding so as to indicate the knot more clearly.

Pinning to fix bandages should be done with safety
pins. If pins are used, care must be taken not to pric
the skin, and they must never be placed between a splin
and a limb.

CHAPTER IX

TRIANGULAR BANDAGES

HE triangular bandage is the most useful type for first d work, as it is easily improvised and simple to apply. : usually consists of calico or linen and is made by cutng either a 36- or 42-inch square diagonally into two alves or triangles.

USES OF THE TRIANGULAR BANDAGE

. **The various parts of the bandage** (Fig. 44)

(i) The **apex** or point.

ii) The **base** or lower side, which is the longest (52–60 inches).

ii) The two **sides.**

v) The two **ends.**

v) Inner and outer **surfaces** — the inner being that next to the body.

Forms of the triangular bandage and their uses (Fig. 44)

i) **Open bandage** or whole cloth can be used for —

(*a*) Large arm-sling.

(*b*) Keeping dressing in place on scalp, chest, abdomen, shoulder, elbow, hand, hip, knee, or foot.

(*c*) Fanning.

ii) **Broad-fold** is made by bringing the apex of the bandage down to the base and then folding it again. It can be used for —

(*a*) Small arm-sling.

(*b*) Immobilising certain fractures where splints cannot be used.

(*c*) Tying lower limbs together when one is fractur
and a splint is not used.

(iii) **Narrow-fold** is made by folding the broad-fold on
to reduce its width by half. It can be used for —

(*a*) Keeping dressings in place.

(*b*) Applying pressure to wounds to stop bleeding.

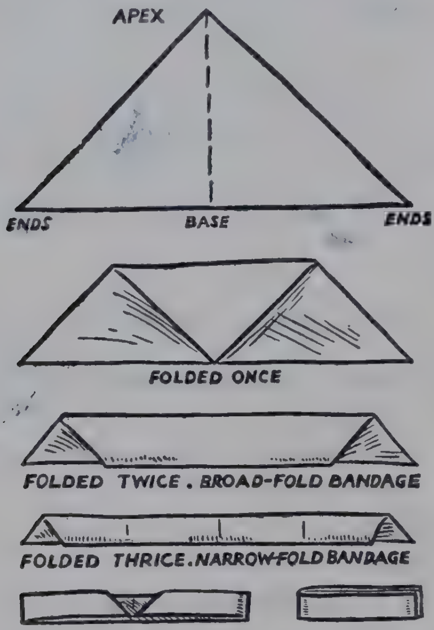


FIG. 44.—TRIANGULAR BANDAGE FOLDED FOR APPLICATION
The two lower figures show the bandage as folded for packing

(*c*) Keeping splints in position.

(*d*) Padding splints.

3. **To pack the triangular bandage** it should be mad
into a narrow-fold bandage, the two ends brought to me
in the centre, then folded in again and the bandage double
on itself (Fig. 44). When not in use, bandages should b
washed, ironed, and stowed folded.

4. **Slings.** Triangular bandages make ideal slings.

(i) **The large arm-sling** (Fig. 45):

(*a*) Stand in front of the patient and get him to han
his arms by his sides.

(*b*) Apply the open triangular bandage to the front of his chest, with the apex towards the injured arm.

(*c*) Place the upper end of the bandage over the

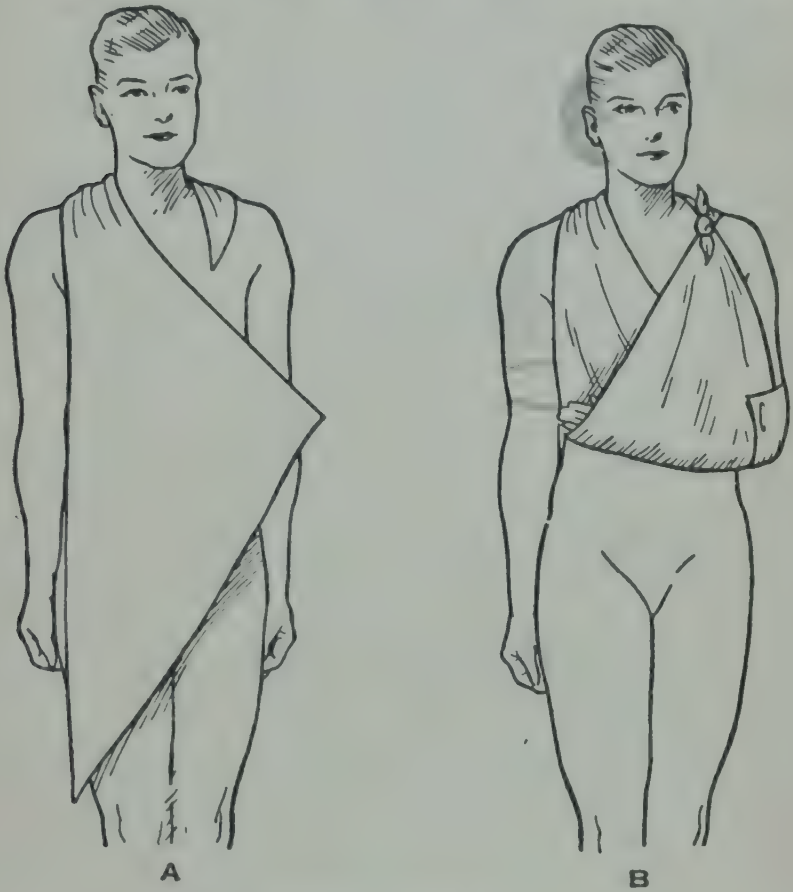


Fig. 45—Large Arm-Sling

sound shoulder and let the other end hang down towards the ground.

(*d*) Carry the upper end round the back of the neck and forwards over the shoulder of the injured side.

(*e*) Bend the injured arm carefully at the elbow and place the forearm across the chest, with the hand (thumb upwards) pointing to the opposite shoulder.

(*f*) Bring up the lower end of the bandage over the

forearm and tie it to the upper end in front of th shoulder on the injured side just below (not on the collar-bone.

(*g*) Fold the apex forwards over the elbow and fix with a safety pin.

(ii) **The small arm-sling** (Fig. 46):

(*a*) Use a broad-fold bandage.

(*b*) Stand in front of the patient and lay one end of the bandage over the sound shoulder.

(*c*) Bring it round the back of the neck and forwards over the shoulder of the injured side.

(*d*) Bend the elbow of the injured arm carefully, placing the wrist and hand in the bandage so that they are a little higher than the elbow.

(*e*) Bring up the lower end of the bandage and tie with upper end just below the collar-bone on the injured side

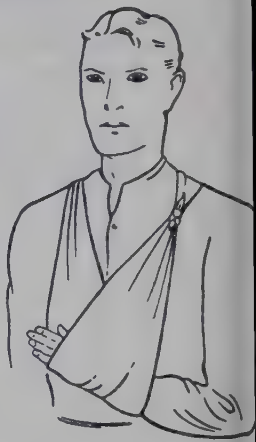


Fig. 46.—Small Arm-Sling

(iii) **Improvised slings** can be made by —

(*a*) Placing the injured arm inside the buttoned-up coat or waistcoat.

(*b*) Pinning the sleeve-cuff of the injured arm to the lapel of the coat on the uninjured side.

(*c*) Turning up the bottom edge of the coat on the injured side, and pinning it to the opposite lapel.

(*d*) Using belts, braces, neckties, or tapes.

(iv) **Cautions when applying slings:**

(*a*) When the sling is applied, the edge (base) should be brought to the root of the nail of the little finger, so that all the **finger-nails** are **exposed** as by their appearance the state of the circulation in the hand and upper limb generally can be gauged. A white or bluish colour of the nail shows that the circulation is being interfered with and requires alteration of the position of the

hand, or removal of the sling, or adjustment of splints or bandages.

(*b*) **The knot of the sling** must not be placed on the back of the neck, nor on the opposite side of the neck from the injured limb. At both these positions it will press uncomfortably on the skin, as the drag of the bandage is on these points.

(*c*) The bandage must be kept as low down at the back of the neck as possible, and below the collar if a coat is worn. The bandage can be kept down off the neck by fastening it with a safety pin behind. This also prevents it getting into a ruck, which makes a sling uncomfortable to wear.

APPLICATION OF TRIANGULAR BANDAGES TO VARIOUS PARTS OF THE BODY

Triangular bandages may be used to fix dressings on various parts of the body. In practising, the first-aider should place a pad of wool or similar material on the part to be bandaged, to simulate a dressing.

. **Bandage for the hand.** Spread the triangular bandage flat upon a table or other support with the apex away from the patient. Place the open hand, palm downwards, 3 inches from the base of the bandage. Bring the apex over the hand, wrist, and lower part of the forearm

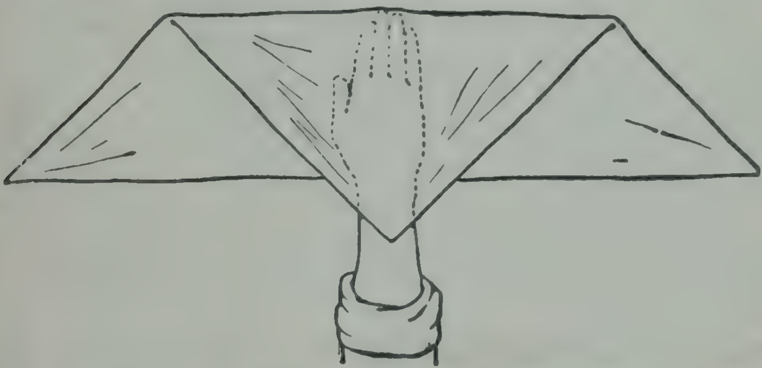


FIG. 47.—BANDAGE FOR THE HAND (COMMENCING)

(Fig. 47). Cross the ends over the back of the hand, ar pass them round and round the wrist, tying off on the ba of the wrist. Bring the apex down over the knot ar secure it with a pin to the bandage over the back of th hand (Fig. 48). If no pin is available, t half the knot, bring the apex downward over it and complete the knot, the apex bein secured between the halves of the knot.

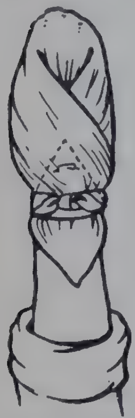


Fig. 48.—Hand Bandage (completed)

2. **Bandage for the wrist.** Place the pal of the hand in the centre of a narrow-fol bandage. Gather the ends together an carry them round the hand (leaving th thumb free), cross the bandage over the bac of the hand and wrist, and round and roun the wrist and lower part of the forearm, an tie off on the back of the limb.

3. **Bandage for the elbow.** Bend th elbow to a right angle. Fold 3 inches of th base of the bandage over on to the main par of the bandage. Lay the bandage thus folded over th back of the elbow with the apex half-way up the bac of the arm, the base (with the folded edge next to the skin) being just above the middle of the forearm. Gather the ends together, cross them over the front of the elbow, bring them to the back of the limb above the elbow, and pass them round and round the arm 3 inches above the elbow. Tie off behind. Bring the point down over the knot and elbow, and pin off on the back of the forearm (Fig. 49).

Fig. 49.—Bandage for the Elbow

4. **Bandage for the shoulder.** Two triangular bandage are required (Fig. 50). Place the centre of one bandag

over the shoulder with the apex resting on the neck below the left ear. Fold in the lower border of the base of the bandage to the extent of 3 inches. Take these ends and carry them round and round the middle of the arm and tie them.

Now apply a narrow arm-sling with the knot in front of the affected shoulder. Bring the apex of the first bandage down over the knot, and pin it to the bandage just above the point of the shoulder.

Fig. 50.—Bandage for the Shoulder

5. **Bandage for the chest.** Stand in front of the patient. Lay an open triangular bandage on the front of the chest with the apex well over one shoulder (Fig. 51, A). Turn the lower border inwards for 3 inches. Gather the ends together and carry them round the patient's body to the back. Tie the ends behind in a vertical line below the shoulder. After the knot is tied, carry the long end vertically up-

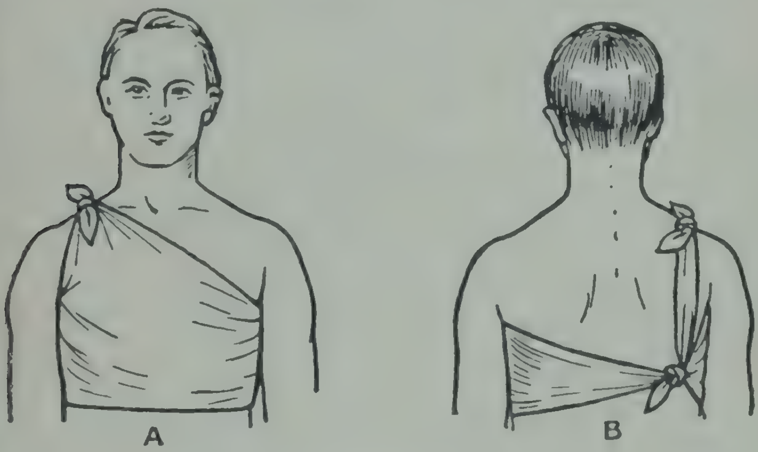


Fig. 51.—Bandage for the Chest

wards and tie it to the apex on the top of the shoulder (Fig. 51, B).

6. **Bandage for the back.** Stand behind the patien

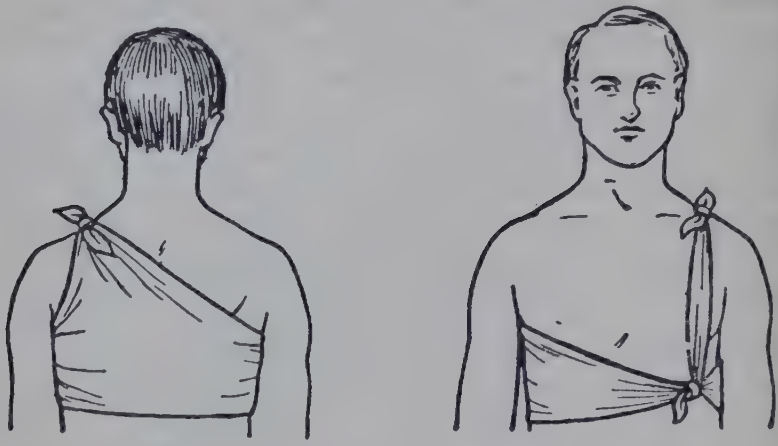


FIG. 52.—BANDAGE FOR THE BACK

Lay an open triangular bandage on the back with the apex well over one shoulder (Fig. 52, A). Turn the lower border inwards for 3 inches. Gather the ends together and bring them round the body to the front. Tie the ends in front in a vertical line from the left shoulder. Carry the longer end vertically upwards and tie it to the apex on the top of the shoulder (Fig. 52, B).

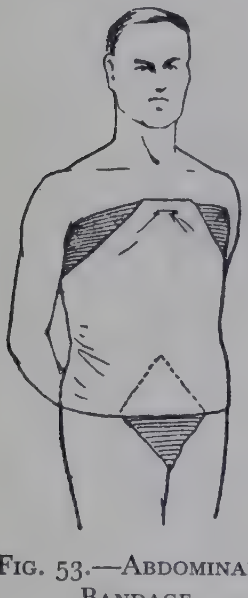


FIG. 53.—ABDOMINAL BANDAGE

7. **Bandage for front of the chest and the abdomen.** Lay an open triangular bandage on the front of the body, base upwards. Gather the ends of the bandage and pass them round the body horizontally below the armpits, and tie behind. Lay a second triangular bandage on the front of the body, with the base at the lower part of the abdomen. Tuck the apex over the top of the upper bandage, and pin it there. Tie the ends of the lower bandage behind. Then turn up the apex of the first bandage, and pin off (Fig. 53).

8. **Bandage for the hip or groin.** Two bandages are required. Stand or kneel facing the hip to be treated. Pass a narrow-fold bandage round the body with its centre at the opposite hip. Tie the ends on the outer side of the hip to be treated. Lay a second bandage — open triangular — on the hip with its apex upwards. Pass the apex beneath the first bandage at the point where the knot is, and draw it through for a distance of 4 inches. Turn in for 2 inches the base of the second bandage. Pass the ends horizontally round the thigh about 1 inch above the lower edge of the bandage, and tie on the outside of the thigh. Pull the apex so that the bandage lies smoothly, and turn it down over the knot. Then pin the apex to the bandage on the outer side of the hip (Fig. 54).

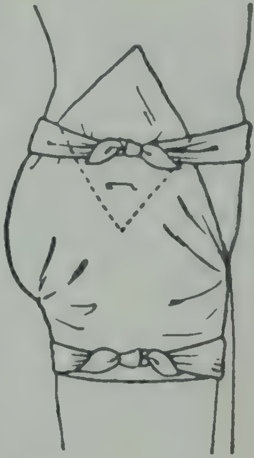


FIG. 54.—BANDAGE FOR THE HIP OR GROIN

FIG. 55.—BANDAGE FOR THE KNEE

9. **Bandage for the knee.** Lay a triangular bandage open on the front of the knee to be covered, so that its apex is in front of the middle of the thigh. Turn in the lower border for about 2 inches. Cross the ends behind the knee-joint and bring them forwards, tying them above the knee-cap on the front of the thigh. Pull the apex until the bandage is taut, fold it down over the knot, and pin it to the bandage over the front of the knee (Fig. 55).

10. **Bandage for the whole foot.** Place the centre of an open triangular bandage against the sole of the foot, so that the apex points in the same direction as the toes. Draw the apex over the toes and let it rest over the instep, pointing up the front of the leg. Gather up the two ends, bringing

them forwards so that the heel is covered. Cross them i front of the ankle-joint. Take them round the back c the ankle and, after crossing them bring forwards and tie in front c the ankle. (If the bandage i long, instead of tying here, cros the free ends and take them round the sole of the foot and tie of on the front of the ankle.) Draw the apex forwards, and pin to th bandage between the instep and toes (Fig. 56).

FIG. 56.—BANDAGE FOR THE FOOT

11. **Bandage for the ankle.** In the case of a sprain or other injury to the ankle, do not re- move the shoe or boot, but simply loosen the lace: only remove the shoe if there is an open wound to be dressed, or much swelling. Place the centre of a narrow-fold bandage on the middle of the sole. Bring the ends upwards, cross them on the top of the foot close to the front of the ankle. Carry them round the ankle, cross them behind, and bring them forwards round the ankle to the front. Cross them again and carry them to the sole and tie (Fig. 57).

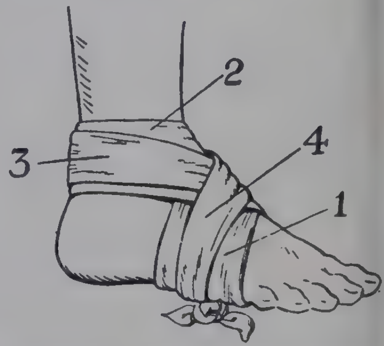


FIG. 57.—BANDAGE FOR THE ANKLE

12. **Bandage for the scalp**

(i) To retain a simple dress- ing. Stand behind the patient. Lay an open triangular bandage on the top of the head with the apex at the centre of the neck behind. Turn in the lower border for 2 inches. Bring the edge down over the forehead as far as the eyebrows. Gather the ends together and carry them round the head just

above the ears to the back. Cross the ends over the apex at the nape of the neck. Then bring them forwards round the head above the ears, and tie them in a knot in the centre and close to the lower border of the bandage. Pull the apex well down behind until the bandage over the scalp is quite smooth. Turn up the apex, and pin it to the bandage on the top of the scalp (Fig. 58).

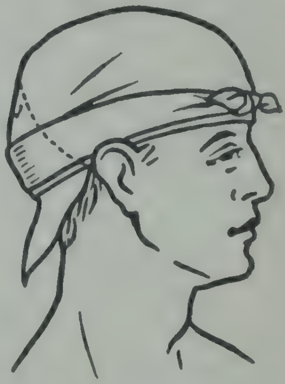


FIG. 58.—BANDAGE FOR THE SCALP

(ii) A bad scalp wound or one associated with fractures of the skull should be treated by means of a **ring-pad**. To make this, wind a narrow-fold bandage round and round two or more fingers (depending on the size of wound to be covered) until only 2 feet of the free end remain. Now wind this end through and around the ring as though to make a quoit (Fig. 59). Place the ring-

FIG. 59.—A RING-PAD

FIG. 60.—RING-PAD IN POSITION

pad over the wound so as to clear its edges. Apply a narrow-fold bandage to keep the ring-pad in place and tie it on firmly, the knot being over the centre of the ring (Fig. 60).

13. **Bandage for the eye.** Stand in front of the patie
Lay the centre of a narrow-fold bandage on the pad
dressing over the eye. Carry one end over the affect

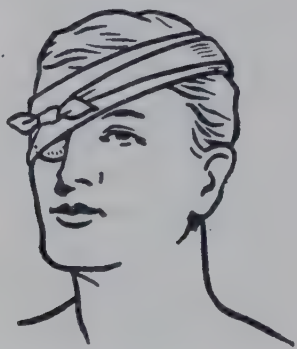


FIG. 61.—BANDAGE FOR THE EYE

side of the head at the top of the temple. Carry the oth
end downwards below the ear of the affected side to th
back of the head. Cross the ends behind and bring the
forwards over the bandage already applied, and tie off ov
the pad on the affected eye (Fig. 61).

CHAPTER X

ROLLER BANDAGES

1. THE BANDAGE

1. **Materials**

(*a*) **Cotton** is the material commonly used for making roller bandages.

(*b*) In teaching and practising the art of roller bandaging, unbleached **calico** should be used, as owing to its stiffness and substance the correct methods of making reverses and figures-of-eight are more easily learnt.

(*c*) **Gauze** is useful as a means of retaining dressings, especially round the neck and over the breast, but does not afford the support to the limbs that is given by stouter materials.

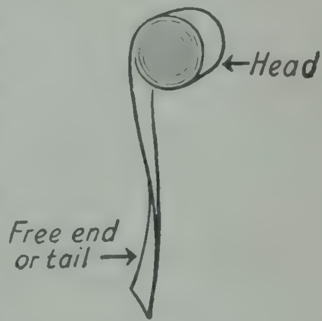


FIG. 62.—PARTS OF A ROLLER BANDAGE

(*d*) **Flannel and domett** are used for retaining dressings and for fixing a limb on to a splint.

(*e*) **Muslin** is employed in the application of plaster-of-Paris and starch bandages.

(*f*) **Adhesive plaster** may be used instead of bandages to retain dressings in position.

. **Named parts of a roller bandage.** When a roller andage is ready for application the roll is termed the **head**', and the loose end the 'free end', or '**tail**' Fig. 62). In applying a bandage the head or roll is

grasped in one hand and the tail or loose end in the oth hand, placing the loose end so that the outer surface against the skin.

3. **To make up a roller bandage.** The two essentials i rolling up a bandage are that it be done tightly and th the edges be even. Frayed edges must be trimmed. I rolling up by hand, begin at one end of the strip by makin a few rolls as a core: a pencil makes a good core. Nex

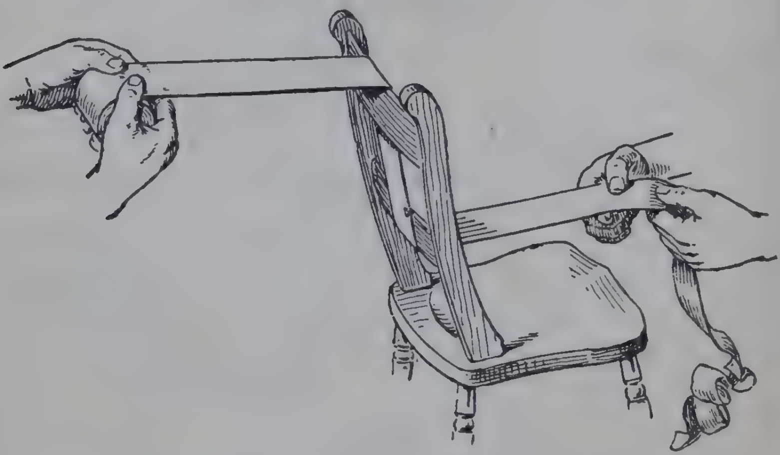


Fig. 63.—Bandage passed over Bars on Back of Chair to keep it smooth and tight in rolling

hold the bandage as in Fig. 63 — that is, with the thumbs above and the forefingers beneath the strip, the ball of the thumbs pressed against the sides of the roll so as to keep all in place. Feed the bandage to the upper part of the roll (Fig. 63), and, with the forefingers beneath, press upon the head of the bandage so that it is kept tight. There are various devices to keep the bandage smooth and tight as it is being 'fed' to the roll. One person may simply hold the loose end, smoothing the creases if there are any, and keeping it fairly tight as it is slipped through the fingers, or the bandage may be run over the bars o the back of a chair (Fig. 63). If no helper is at hand, the free end may be tied to the end of a bed or to a chair.

The use of a bandage rolling machine is the most efficient method of rolling a good bandage (Fig. 64).

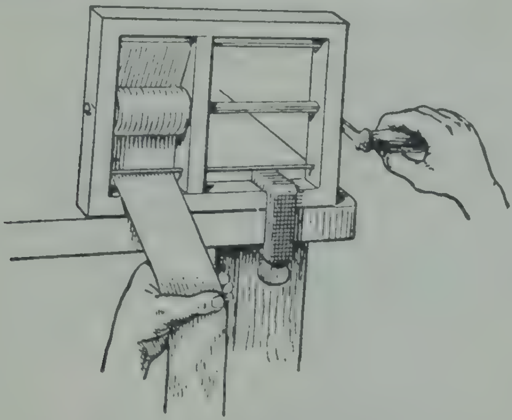


FIG. 64.—ROLLING MACHINE
The handle, with the rod it turns, is pulled out when the rolling is complete

4. Uses of roller bandages

(*a*) To retain dressings and splints in position.
(*b*) To prevent haemorrhage from small blood-vessels after injury or operation ; for this purpose the bandage must be applied evenly and firmly over a pad of cotton-wool.
(*c*) To prevent swelling, and to support a joint after it has been sprained or dislocated.
(*d*) To prevent too much blood pooling in the legs as in shock or collapse, when the legs may be bandaged firmly, but not tightly, from the toes upwards.

5. Widths and lengths of roller bandages

Part to be bandaged	Bandage	
	Width in inches	Length in yards
Finger . .	$\frac{3}{4}$–1	1$\frac{1}{2}$–2$\frac{1}{2}$
Arm . .	2–2$\frac{1}{2}$	4–6
Leg . .	3–3$\frac{1}{2}$	6–8
Body . .	4–6	8
Head . .	2–2$\frac{1}{2}$	6

6. Turns used in roller bandaging

Simple spiral — for wrist and ankle.

Reverse spiral — for fleshy parts, calf, thigh, forearr biceps.

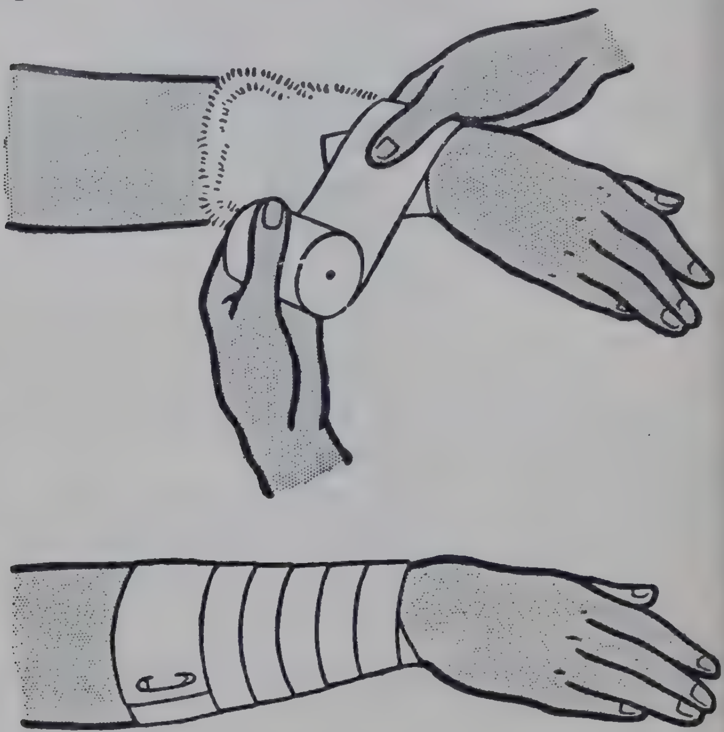


FIG. 65.—SIMPLE SPIRAL BANDAGE

Figure-of-eight — for joints — wrist, elbow, ankle, an knee.

Spica — for hip, shoulder and thumb joints.

(*a*) **Simple spiral** is used for parts of uniform thick ness, such as the wrist and ankle. The bandage i applied obliquely round the part, each turn coverin two-thirds of the preceding one, the edges bein kept parallel (Fig. 65).

(*b*) **Reverse spiral** is used when the fleshy part of th limb is reached, for example, the forearm, bicep calf, or thigh. Spiral turns are made to the poin

where they will not lie evenly (Fig. 66), when the lower edge of the last spiral is fixed with the thumb

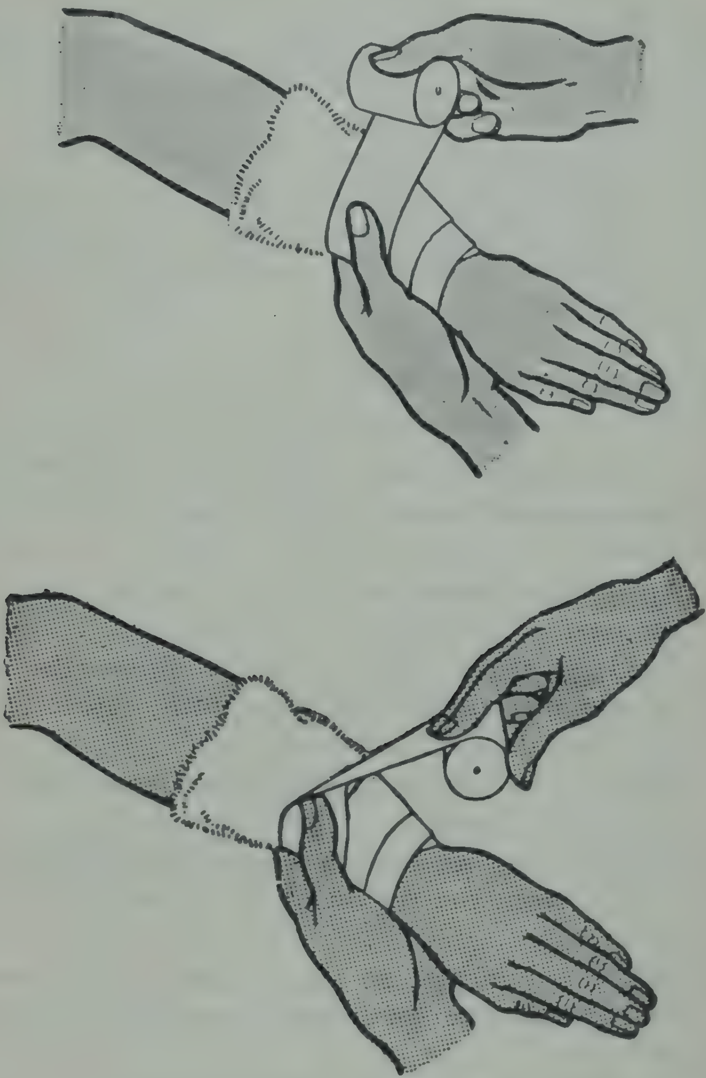


FIG. 66.—REVERSE SPIRAL BANDAGE

on the outer side of the limb. The bandage is then reversed by slackening it and bringing its head

obliquely down over the thumb, passed round th
limb and reversed again just above the point of th
first reverse, and so on upwards.

(c) **Figure-of-eight** is used to cover joints, as neither
simple nor a reverse spiral will lie evenly over them
The technique of its application is indicated a
Figs. 71, 72, and 73.

(d) **The spica** is a form of the figure-of-eight in whic
one turn is very much larger than the other and
used for the shoulder, groin, or thumb. For detail
see spica bandage for shoulder, page 106, and Figs
75, 76.

RULES TO BE OBSERVED IN APPLYING ROLLER BANDAGES

1. Use only **tightly and evenly rolled bandages**.
2. **Never unroll more** than 3–4 inches of a bandage a a time.
3. **Apply the outer side** of the tail of the bandage to the part.
4. Bandage **limbs from below upwards** and from **within outwards** over their front, and in the position in which they are to remain.
5. Bandage the **chest from below upwards**; that is, from the lower ribs towards the shoulders.
6. Bandage the **abdomen from above downwards**; that is, from the region of the stomach downwards to the pelvis.
7. Apply a bandage so that **each layer covers two-thirds of the previous one**, keeping the edges parallel.
8. **Bandage evenly and firmly**, but not with enough pressure to interfere with the circulation. A pad of cotton-wool placed evenly over the part permits a bandage being applied firmly without unduly compressing the veins.

9. **Stand in front of the hand or foot**, not on one side of the limb, when bandaging an arm or leg, and support it the while.

10. In applying a bandage to the limbs to retain dressings or splints, **do not cover the tips of the fingers or toes**, but leave the nails visible. By the appearance of the nails, the state of the circulation can be judged; a bluish colour of the nails indicates that the veins are being compressed, and numbness, swelling, and immobility of the fingers or toes show that the bandage wants slackening or the splints and dressings re-adjusting.

11. Make all **reverses or crossings in a line** on the outer side of the limb.

12. Bandage the **knee** with this joint **straight**.

13. **Bend the elbow-joint to a right angle** before bandaging and place a good pad of cotton-wool in front of the joint.

14. **Finish off the bandage** with a simple turn, fold in the end and fasten it with a safety pin.

BANDAGES FOR THE UPPER LIMB

To bandage the hand and wrist use a bandage inches wide. Lay the **outside** of the bandage on the ront of the wrist, with fingers extended and palm turned ownwards (Fig. 67). Carry the bandage obliquely over the ack of the hand, round the little-finger side, across the alm, round the forefinger side and horizontally across e back of the fingers, so that the lower border of the andage just touches the root of the nail of the little finger Fig. 68). Pass the bandage again round the front of the and, round the forefinger, and obliquely upwards to ncircle the wrist. Repeat the turns round the hand and vrist three or four times, making figure-of-eight loops

(Fig. 69). The crossings of the bandage should come i the middle of the back of the hand, each turn exposin one-third of the previous turn.

FIG. 67.—BANDAGE FOR HAND AND WRIST (COMMENCED)
First-aider is facing the patient

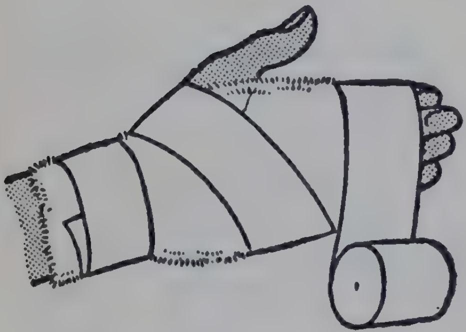


FIG. 68.—BANDAGE APPLIED TO HAND

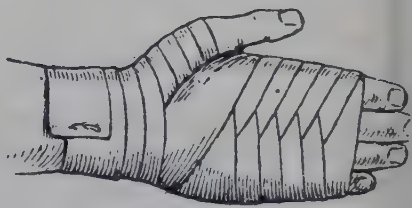


FIG. 69.—FIGURE-OF-EIGHT BAND-AGE FOR HAND, AND SIMPL SPIRAL FOR WRIST

2. **To bandage the forearm** use a 2- or 3-inch band-age. After bandaging the hand, take three turns up-wards from the wrist, carrying the bandage up the limb as a **simple spiral**, so that one-third of the previou turn is exposed. On reaching the more muscular par

f the forearm it will be found that the simple spiral ırns no longer lie evenly on the limb, the lower border ecoming loose. To obviate this, it is necessary to make n ascending **reverse spiral** (Fig. 70). To do this, ıpport the forearm with the fingers of the free hand, arry the bandage across the back of the forearm, keeping s head inclined upwards so that the bandage lies flat on ıe skin: whilst it is in this position, place the thumb of ıe hand supporting the limb on the bandage just below s upper border, and bring its head downwards, so that

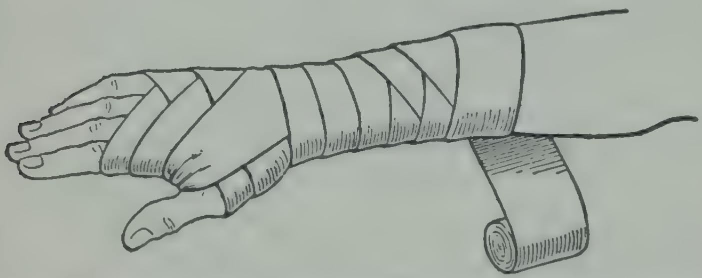


FIG. 70.—BANDAGE FOR HAND AND FOREARM SHOWING REVERSES

ıe upper edge folds over the thumb, making a ' reverse '. arry the bandage again round the limb and repeat the everse, and continue up the forearm towards the elbow, ıch turn exposing one-third of the breadth of the previously pplied turn.

To bandage the tip of elbow use a 3-inch bandage. ay the outer side of the bandage on the inner side of the bow; carry the bandage round the arm over the tip of ıe elbow, which must be kept at a right angle. Now make ırns, in a figure-of-eight manner, to encircle alternately rst the upper arm and then the forearm. Each turn should verlap the previous one by two-thirds of the width of the andage. Continue these figure-of-eight turns until 6 or ıore are made (Figs. 71, 72, and 73).

. **To bandage the upper arm** use a 3-inch bandage. end the elbow to a right angle and apply the bandage

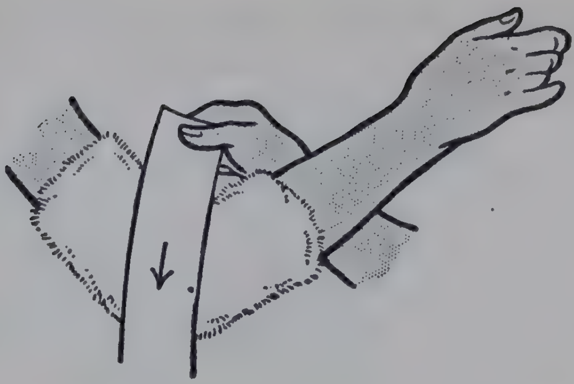


FIG. 71.—COMMENCING BANDAGE TO COVER TIP OF RIGHT ELBOW
The hanging end is passed to inner side as the first turn is being completed

FIG. 72.—BANDAGE TO COVER TIP OF RIGHT ELBOW, SHOWING EARLY TURNS

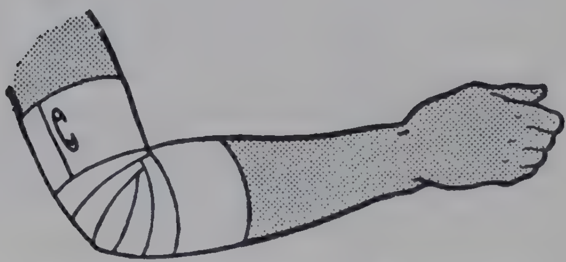


FIG. 73.—BANDAGE TO COVER TIP OF ELBOW COMPLETED

ıoulder and round the back to emerge under the opposite rmpit. Next, carry the bandage across the front of the ıest and round the shoulder. Repeat this figure-of-eight

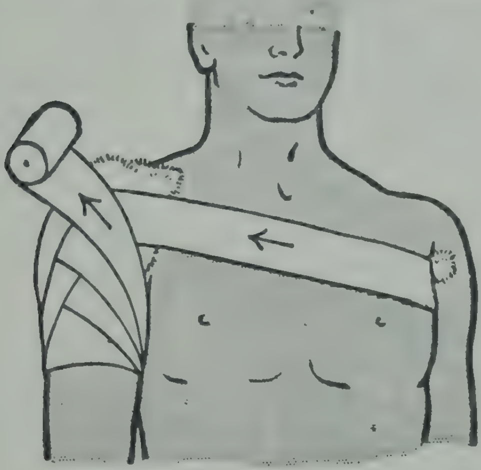


Fig. 76.—Spica Bandage for Right Shoulder

ırn round the shoulder four or more times, until it is comletely covered. Finally, fix the bandage in front with a ıfety pin.

BANDAGES FOR THE LOWER LIMB

If the patient is in bed, elevate the heel on a support inches high. If he is up and about, seat him in a chair ith his foot supported on a stool or another chair. Alterıtively, rest patient's heel on your knee.

To bandage the foot and ankle. Lay the outer side the bandage on the inner side of the limb on a level ith the ankle. Take a turn round the ankle to fix the ındage, and then carry it obliquely across the top of the ot to the root of the little toe (Fig. 77). Pass the bandage ɔund the sole on a level with the balls of the toes to the ıner side of the ball of the great toe, then cross the top f the foot horizontally on a level with the root of the little

toe, and once more across the sole to the inner side of t
foot. Next take the bandage across the top of the foot a
make a turn round the ankle just above the heel. Contin
to make figure-of-eight turns round the foot and ank
each turn overlapping the one preceding by two-thirds
its width, until the rest of the foot and ankle are covere
Finish off by making a simple spiral turn round the ankl
and pin off (Fig. 78).

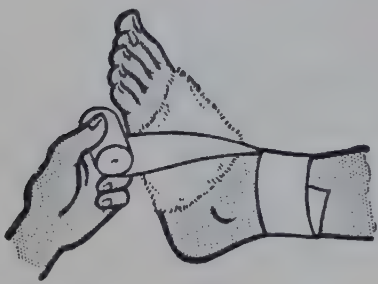


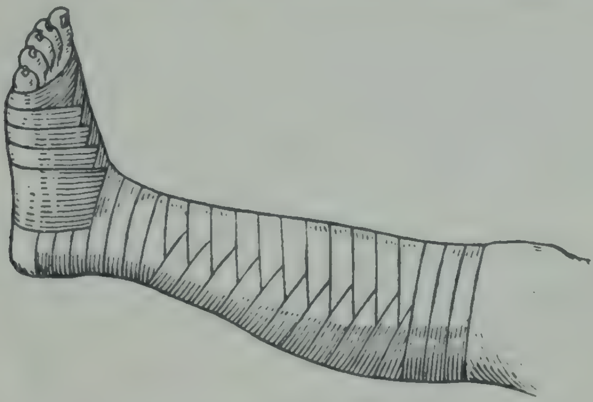
FIG. 77.—COMMENCING BANDAGE FOR FOOT AND ANKLE

FIG. 78.—BANDAGE FOR FOOT AND ANKLE COMPLETED HEEL LEFT BARE

2. **To bandage the lower leg.** Bandage the foot an
ankle as in (1) above and carry the bandage up the leg in
reverse spiral (Fig. 79) to 3 inches below the knee (that i
to where the fullness of the calf ends). Then make thre
turns of a simple spiral to finish. Note that the reverse
should be made on the outer, muscular part of the leg
never over the sharp edge of the shin-bone in front.

3. **Bandage to cover the heel.** Apply a figure-of-eigh
using a 3-inch wide bandage. Support the leg so tha
the foot projects over the edge of a stool or chair, the foo
being kept at a right angle to the leg. Bandage fron
within outwards round the ankle and tip of the hee
(Fig. 80). Make a second turn, the bandage being jus
a little above the point of the heel behind. Carry th
third turn just below the point of the heel, and the fourt
turn a little higher than the second, and the fifth a littl

wer than the third. When the fifth turn reaches the ner side of the foot, pass the bandage behind the tendon



G. 79.—BANDAGE FOR LOWER LEG CARRIED AS FAR AS THE KNEE, SHOWING FIGURE-OF-EIGHT FOR FOOT, ASCENDING SIMPLE SPIRAL FOR LOWER PART OF LEG, ASCENDING REVERSE SPIRAL FOR CALF OF LEG, AND ASCENDING SIMPLE SPIRAL JUST BELOW KNEE

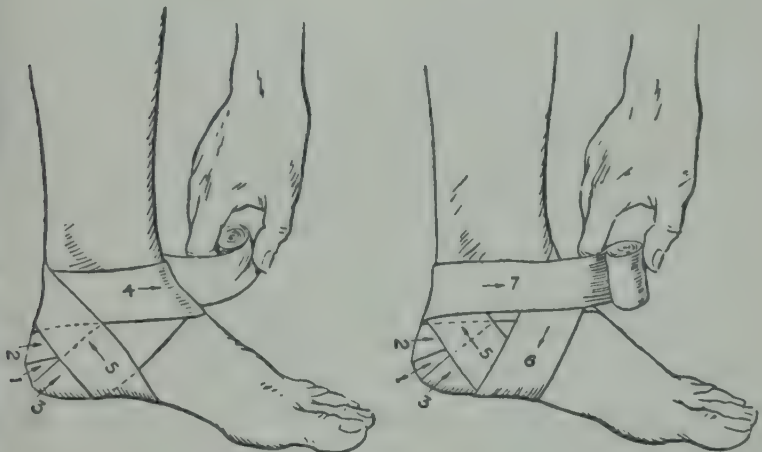


FIG. 80.—BANDAGE FOR THE HEEL

The numbers indicate the order of the turns of the bandage round the foot

the heel **(tendo Achillis)** and complete a figure-of-eight ovement round the foot and ankle, and finish off as a nple turn just above the ankle.

4. **Bandage to cover the knee.** Bend the knee slight Apply an even layer of wool. Lay the outer side of a $3\frac{1}{2}$-in bandage against the inner side of the knee. Make a tu over the knee-cap. Carry the bandage round the knee figure-of-eight fashion, the first turn being just below t knee-cap, the second just above it. Continue to make furth turns until the whole knee is covered, each turn overlappi

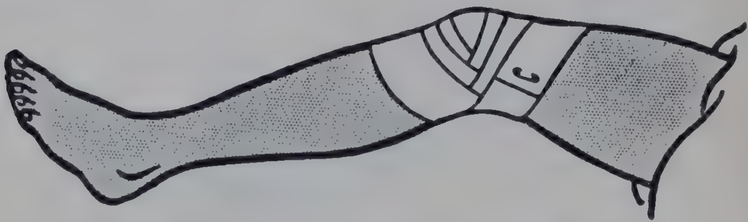


FIG. 81.—BANDAGE FOR THE KNEE

that underneath by two-thirds of the width of the bandag Finish off by a simple turn round the thigh (Fig. 81).

5. **To bandage one groin** use a '**single spica**'. Th bandage is best applied with the patient standing, or if he lying down the pelvis should rest on a solid support. U a 4-inch bandage and place a pad over the groin represent a dressing. Stand at the side to be bandage Pass the bandage along the groin from within outwar round the crest of the hip. Carry it forward from th opposite side over the lower part of the abdomen to cro the first turn directly over the pad. Then pass it roun the thigh to complete the first figure-of-eight. Make series of similar turns, as is shown in Fig. 82, until the pa is covered and fixed in place.

6. **To bandage both groins** use a '**double spica**' Stand in front of the patient if he is standing, or at th right side if he is in bed, his pelvis being supported. Use 6-inch bandage at least 8 yards in length. Begin in th same way as for a single spica for the right groin, carrying th bandage from the right groin round the pelvis, but dov over the left groin round the back of the left thigh. Aft bringing the bandage up on the outer side of the left thig

ırry it across the abdomen to the right side and encircle ıe body at the waist. Bring it down across the front the abdomen to the right groin, crossing the first turn the bandage there. Then pass the bandage across the ont of the right thigh to the outer side, round the back the inner side of the left thigh to complete the turn. Take a series of these turns, bearing in mind that the ındage must be passed round the waist up to the level of ıe navel (Fig. 83).

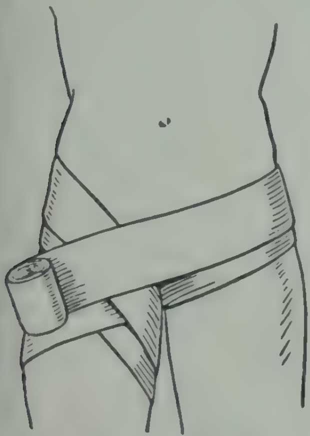


FIG. 82.—SINGLE SPICA BANDAGE FOR RIGHT GROIN

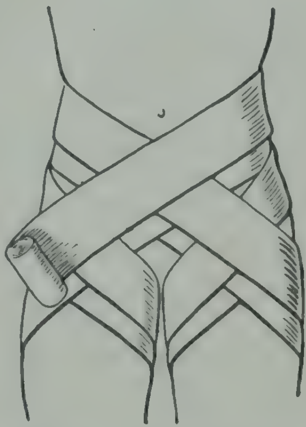


FIG. 83.—DOUBLE SPICA BANDAGE FOR BOTH GROINS

BANDAGES FOR THE HEAD

Eye bandage. Take a 2-inch bandage $1\frac{1}{2}$ yards in ıgth. Place the bandage on the forehead above the ected eye and carry it round the forehead above the ınd eye until it reaches the ear of the sound side for e second time. Then take it obliquely down the side of e head over the prominence at the back of the head, lled the occiput, and carry it up beneath the ear of the fected side and over the pad on the eye, to the circular ırn round the head, to which it is pinned (Fig. 84). If

this does not give sufficient support, make further obliq
turns to cover the dressing as indicated in Fig. 85.

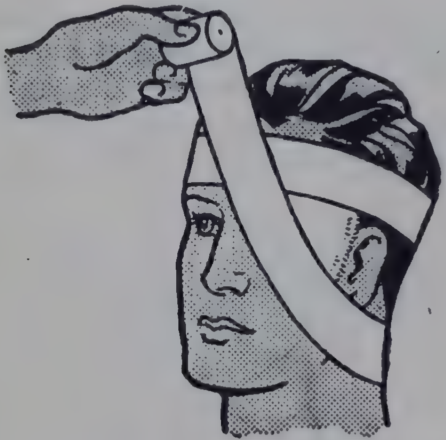


FIG. 84.—EYE BANDAGE

FIG. 85.—EYE BAND-
AGE SHOWING FUR-
THER TURNS

2. **Ear or mastoid bandage.** Use a 3-inch bandag
Stand on the affected side of the patient, and place a pa
or dressing over the affected part. Lay the free end of th
bandage above the affected ear and carry the bandag
forwards in a circular manner round the forehead an
occiput. Carry the second turn of the bandage down t
the nape of the neck to cover the lower edge of the dressin
and then up over the forehead (Fig. 86). Repeat th
figure-of-eight bandaging for five turns or until the who
ear dressing is covered. Finish with one horizontal tur
and pin just above the affected ear (Fig. 87).

3. **Capelline bandage.** This is a double-headed roll
bandage ($2\frac{1}{2}$ inches wide) sometimes used for the head whe
the whole scalp has to be covered, but in first aid work th
triangular bandage (pages 92–93) is to be preferred. T
apply a capelline bandage, stand behind the patient whi
he is seated on a chair. Apply the outside of the bandag
to the forehead, the lower border of the bandage lying ju

›ove the eyebrows (Fig. 88). Carry each head of the ındage backwards over the side of the temple, and above

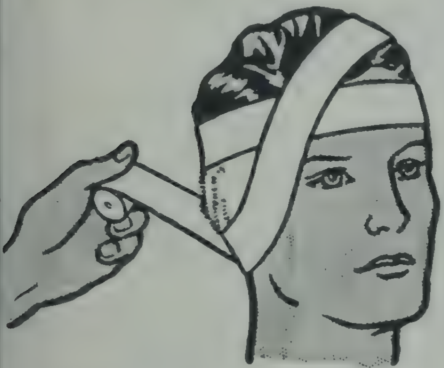


Fig. 86.—Ear Bandage

Fig. 87.—Ear Bandage completed

e ears to the back of the head (Fig. 89). Here cross the ds, and continue the upper bandage round the head, d carry the other upwards over the mid-line of the scalp

. 88.—Commencing Capelline Bandage

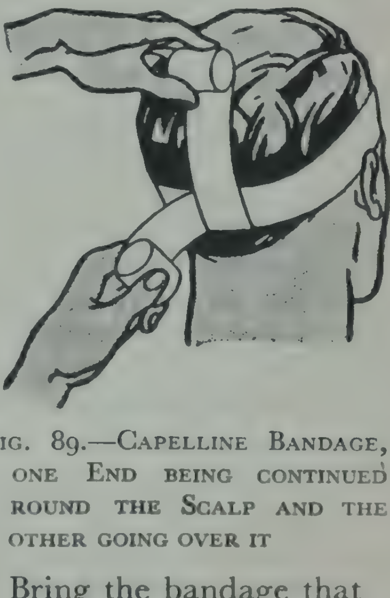


Fig. 89.—Capelline Bandage, one End being continued round the Scalp and the other going over it

the root of the nose (Fig. 90). Bring the bandage that circles the head round the forehead to fix the scalp

bandage. Continue to pass the scalp bandage alternatel backwards and forwards, first to one side and then to th other of the central fold, until the whole scalp is coverec With the bandage that encircles the head, fix each fold the scalp bandage as it is made (Fig. 91). At the finis

FIG. 90.—CAPELLINE BANDAGE, SCALP TURN BEING SECURED BY HORIZONTAL TURN

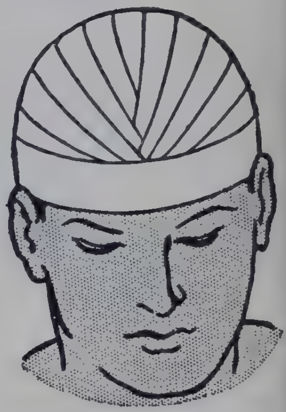


FIG. 91. — CAPELLINE BANDAGE COMPLETED

carry both ends of the bandage round the head horizontall above the ears, and fix with a safety pin.

4. **Barrel bandage for the chin.** Use a 2-inch bandag Place the middle of the bandage well back under the chi bring it up on both sides over the angles of the jaw to th top of the head, and tie loosely (Fig. 92). Open up th knot, so as to form two loops, as the two ends of the banda are fed through: lay one loop over the forehead and pa the other down behind to the nape of the neck (Fig. 93 Tighten the two loops and tie the bandage off firmly top of the head (Fig. 94).

BANDAGES FOR THE BODY

For first aid work, the triangular bandage is the b for fixing dressings on the chest and abdomen (see pag 89–90). In this connection roller bandages have a ve

mited use, so that only the breast bandage and the roller owel will be dealt with here. Those interested in other

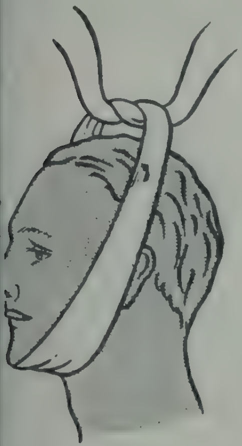


FIG. 92

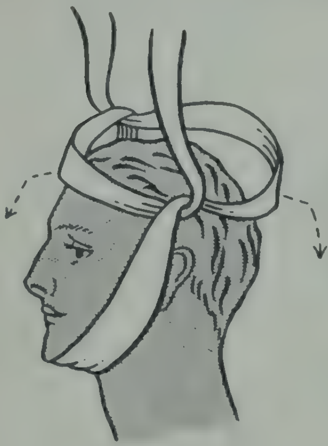


FIG. 93

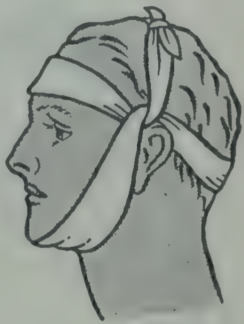


FIG. 94

IGS. 92-94.—THE BARREL BANDAGE FOR FRACTURES OF THE LOWER JAW

orms of roller bandaging for the body will find these escribed in the *B.R.C.S. Nursing Manual No. 2*.

Bandages for the breast

(*a*) To support one breast (*e.g.* the right), take a bandage $3\frac{1}{2}$ inches wide and 8 yards long. Commence the bandage below the breasts and carry it to the left and round the body horizontally twice. At the third turn, carry the bandage upwards beneath the right breast and over the top of the left shoulder, then down the back round the body. Continue making turns round the trunk and one beneath the breast and over the left shoulder, alternately until five, or more, turns are made (Fig. 95).

(*b*) To support both breasts start bandaging round the chest as for one breast. Take the bandage up under the right breast over the left shoulder, obliquely down across the back, under the right arm and across the front of the chest horizontally. Then carry the bandage under the left arm, up across the

back to the right shoulder, and down across th chest under the left breast. From here pass it unde the left arm and horizontally across the back t beneath the right breast again. Repeat these turn until both breasts are covered (Fig. 96).

FIG. 95.—SINGLE BREAST BANDAGE

FIG. 96.—DOUBLE BREAST BANDAG

2. **The roller-towel bandage** is easily applied to the chest or abdomen by wrapping it round the body, and securing it in front with safety pins. Care must be taken not to apply it so tightly as to embarrass the patient's breathing.

CHAPTER XI

SEPSIS AND THE LYMPHATIC SYSTEM

3EFORE dealing with wounds, it is necessary to have an ınderstanding of nature's protective mechanism against estering or **sepsis** and blood poisoning or **septicaemia**.

SEPSIS

Micro-organisms or germs exist everywhere in the vorld — in soil, water, and air. Only certain germs are njurious to man, and these may gain entrance to his ystem through the air he breathes, by way of his food or lrink, or through his skin if it is damaged. Germs are ıormally present on the skin, owing to the presence of ither visible or invisible dirt derived from the surroundings, nd some of these enter the skin when it is abraded or cut. Germs may also enter a wound on the object that has ıused it or on the fingers applied to it or its dressing, nless they are sterilised beforehand.

After injurious germs enter a wound they are liable to ıultiply very rapidly and attack the tissue cells with which ıey come in contact. This attracts blood to the part to elp ward off the germ invasion by mobilising nature's ont-line troops, namely, certain white blood corpuscles **leucocytes** (see page 9). The increased blood-supply ads to local redness, heat, and swelling, and later perhaps the appearance of a white discharge, termed **pus**, which ınsists chiefly of dead or damaged leucocytes and germs. his sepsis may invade the blood-stream direct and be arried away to various parts of the body to form other ›llections of pus, called **abscesses**, or it may spread just

under the skin along small channels or **lymphatics**, visibl
then as red lines of inflammation **(lymphangitis)**.

THE LYMPHATIC SYSTEM

The lymphatic system is the body's second line o defence, and a very strong line of defence it is, ther being a series of blockhouses or fort **(lymph glands)** designed to hold up an invasion by germs which pass the firs line of defence in the wound.

FIG. 97.—DIAGRAM OF LYMPHATICS IN THE ARM DRAINING INTO AXILLARY LYMPH GLANDS

The blood carrying nourishment t and waste matter from the tissues doe not come into direct contact with them but acts through an intermediary, th lymph. **Lymph** is a clear, yellowish fluid which is derived from the blood-plasma by filtration through the thi walls of capillary blood-vessels (see page 13). It bathes the cells of the body a it circulates around them in minut channels, termed **lymphatic spaces**, conveying food and oxygen to the tissues and taking away waste products includ-ing carbon dioxide, which it delivers t the blood for excretion through th kidneys and lungs. From these spaces the lymph passes into fine tubes o **lymphatics**, which eventually drai into the large veins at the base of th neck. At points along the course of thes lymphatics there are filters or **lymph glands** to detain germs and destro them, so preventing their entry into th blood-stream and the body generall (Fig. 97).

The lymph glands occur singly and in groups: example of the main groups are those in the armpit **(axillar**

glands), the groin **(inguinal glands)**, the neck **(cervical glands)**, and in the abdomen in front of the spine **(abdominal glands)**. Normally these glands are very soft and about the size of a small pea and they are difficult to feel, except by the expert, but when inflamed **(adenitis)** they swell, becoming painful and easily felt. The largest lymphatic is the **thoracic duct**. It is as thick as a stout piece of string, and lies in front of the spine. It collects the lymph from the greater part of the body, that from the lower limbs and the abdomen draining into it at its bulb-like commencement **(receptaculum chyli)** lying over the 2nd lumbar vertebra. The lymph flowing from the intestines is rich in liquid food and appears white like milk, so these particular lymphatics are termed **lacteals** ('lac' meaning milk). The thoracic duct discharges its contents into the left subclavian vein (Fig. 98).

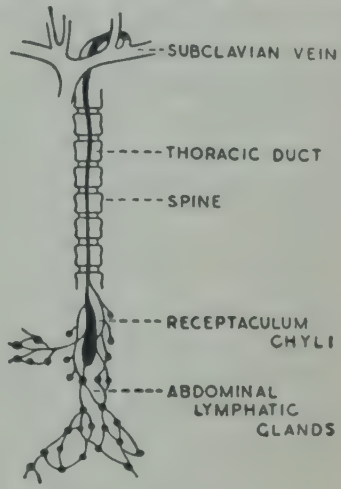


FIG. 98.—DIAGRAM OF THORACIC DUCT

The lymphatic system has, therefore, four important functions:

(i) Absorption of certain food materials from the gut.
(ii) Carriage from blood to the tissues of food materials and oxygen.
(iii) Removal of tissue waste products.
(iv) Protection against germ infection.

Sepsis, whether it is local in the wound or spreading to the lymphatics as lymphangitis or adenitis, is serious and should be referred immediately to a doctor for attention. Prevention is better than cure, however, so the first-aider must take the fullest possible precautions to lessen any risk of adding infection to a wound. To this end, he should cover any wound as quickly as possible with a sterile

dressing, and avoid touching a wound with his fingers, as they are germ-laden. Moreover he should, wherever possible, wash his hands thoroughly for five minutes under running water before dressing a wound, or wipe them over with some disinfectant or antiseptic. If he cannot cleanse his hands properly by washing or by applying an antiseptic, he must not touch the wound with uncovered hands. Even placing a clean handkerchief between the wound and his fingers is better than nothing.

Asepsis means absence of germs, and is the aim of every surgeon. It can be attained only by ensuring that everything which may come in contact with the wound is sterile or free from germs. This includes dressings, rubber gloves, towels, bowls, instruments, etc. It is impossible to make the hands absolutely germ-free, that is why the surgeon and nurse wear sterilised rubber gloves, and why the first-aider should not touch a wound with his bare fingers but guard them with a sterile dressing. At **all** times, however, the first-aider's hands should be kept as clean as possible, free from scratches (as these encourage the growth of germs), and the nails well trimmed. After washing to attend a patient, the hands should be dried on a clean towel or sterile dressing, as wet hands are much more liable than dry ones to spread infection.

Antisepsis is the technique of preventing or treating wound infections by means of chemicals capable of killing germs. For this purpose many products are used, the cresol group being the favourite at present. In their neat state most of them are too strong to apply to the body, but are so used to disinfect bedpans, bowls, baths, sinks, tables, furniture, and certain instruments. These strong solutions are termed **disinfectants** — examples are, dettol, izal, lysol, and superlin. For application to the body tissues they must be diluted to a strength that will do no harm: they are then referred to as **antiseptics**. For first aid work, acriflavine or euflavine is recommended, as both are powerful antiseptics, yet can even be tolerated intravenously and are so used for some blood infections.

CHAPTER XII

WOUNDS

A WOUND is a break in the continuity of the tissues of the body caused by injury, the skin usually being cut or torn so that germs are liable to enter. The deeper the wound is, the greater is the risk of infection as it cannot be cleansed properly.

TYPES OF WOUNDS

1. **Incised wounds** are caused by cutting instruments or objects such as knives, razors, broken glass, or sharp stones or sea-shells. They bleed freely because blood-vessels are cut cleanly and the ends gape. The free flow of blood tends to wash away any germs that enter at the time of injury. There is little or no bruising, and if properly treated they heal readily.

2. **Lacerated or contused wounds** are made by blunt instruments, by falls against rough surfaces, by machinery, by claws of animals, and by bomb splinters, bullets, and shells. There is less bleeding than from incised wounds as the blood-vessels' walls are torn and crushed. The edges of the wounds are ragged and gape, and there is bruising and possibly ingrained dirt. Such wounds are likely to go septic, owing to the damage to the tissues and the bleeding being insufficient to flush the wound thoroughly.

3. **Punctured wounds** are due to stabbing with a nail, needle, hat-pin, splinter, knife, bayonet, or bullet. The surface wound is often small, and, in the case of a bullet passing through the body, the exit wound is larger than

that of entry. There is relatively little external bleeding, though internal bleeding may be great if a large blood-vessel is pierced. Sepsis is liable to occur as dirt, pieces of clothing, and part or whole of the puncturing instrument (*e.g.* needle) are apt to be embedded deeply in the wound. Such wounds are particularly suitable for the growth of the germs of lockjaw **(tetanus)** and **gas gangrene**.

4. **Abrasions or grazes** are due to rubbing or scraping away of the surface skin as by the chafing of a shoe or falling on the road. They really are contused wounds.

5. **Gunshot or missile wounds** may fall into any of the above groups, depending on the missile, the angle and force at which it strikes the body, and the resistance it meets. These wounds are frequently accompanied by considerable shock.

GENERAL TREATMENT OF WOUNDS

Clean incised wounds tend to heal readily if their edges are brought close together, and if asepsis is maintained. The scar which forms is thin. This is referred to as **healing by first intention**. With a lacerated or contused wound, the tissue damage and sepsis lead to some gaping of its edges and the intervening space fills first with blood-clot, then by scar tissue as it heals from the bottom upwards —this is termed **healing by second intention** or **granulation**. The scar is large and liable to stretch. The surgeon treats such wounds by trimming the damaged edges to endeavour to bring them together, so that healing will be by first intention or with as little granulation as possible.

The general aims of the first-aider should be to **stop bleeding and prevent germs from entering** a wound. To this end, wounds should be kept dry and be covered with a sterile dressing. There should be no cleaning of the wound, unless skilled medical aid is not likely to be available for several hours.

1. **Routine first aid procedure** should be on the following lines:

(i) **Handle the injured part as gently and as little as possible**, and avoid causing pain.

(ii) **Sit or lay the patient down**, and, if the injured part is a limb and there are no broken bones, **raise the limb** to lessen the bleeding.

(iii) **Stop bleeding** if profuse either by applying direct pressure to the wound with a sterile dressing or a clean handkerchief, provided there is no glass or other foreign body in the wound, or by pressing on the arterial pressure point as detailed in Chapter V. **Do not disturb any blood-clots**, as this may re-start the bleeding. **Do not remove glass** from a wound unless it can be easily wiped away with a dressing, as its removal may open up a large blood-vessel: apply a ring-pad (see Figs. 59 and 60).

(iv) **Wash your hands thoroughly**, if time and facilities exist, but it is better to risk contaminating a wound and save a life than to let a person bleed to death while preparing your hands and dressings in accordance with the ritual of asepsis.

(v) **Prepare the dressing**, handling it by its edges and being careful not to touch the surface that is to be applied to the wound. A field dressing is ideal (see page 76); otherwise cut a piece of gauze or lint double the size of the area to be covered, and fold it in two ready for application.

(vi) **Place a dry dressing** over the wound. If there is much bleeding, back the dressing with a large pad of cotton-wool to soak up the blood.

(vii) **Bandage** on the dressing firmly. If blood oozes through, apply another layer of cotton-wool over the bandage and put on another bandage.

(viii) **Immobilise the injured part**; place an arm in a sling, unless the wound is a minor one.

(ix) Treat for **shock**.

(x) Transfer case to a **doctor**.

2. **In remote places where there is no doctor or nurse**, the first-aider should be prepared to do more — the area round the wound and the wound itself have to be cleaned.

(i) Proceed as above and **wash your hands thoroughly**.

Fig. 99.—Dressing a Wound

Cover wound with clean dressing while washing around

(ii) **Collect the dressings** needed and place them on a clean, newly-ironed towel or handkerchief.

(iii) **Protect the wound** with a clean, dry dressing or handkerchief.

(iv) **Cleanse the skin around** the wound with soap and clean water (preferably boiled and cooled), being careful not to finger the wound or to let the water run into it (Fig. 99). Clean away from, not towards, the wound.

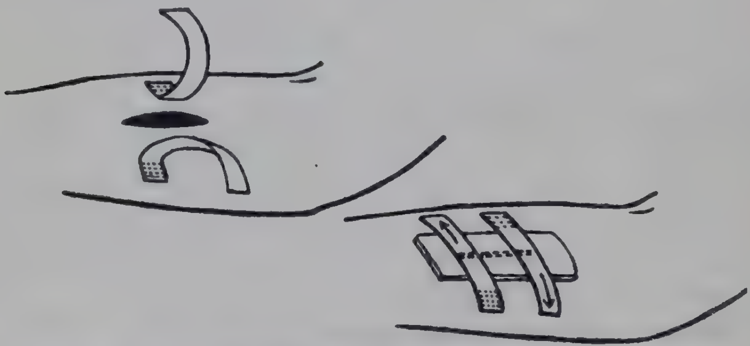


Fig. 100.—Drawing Edges of Wound together

(v) **If the cut is a clean one**, has bled freely, and does not contain any foreign body, apply a dry dressing. When bleeding has stopped, the edges of the wound can be brought close together with a strip of adhesive plaster carried over a piece of sterile gauze (Fig. 100)

(vi) **If the wound is dirty or lacerated,** wash it carefully with cold sterilised water, that is, water that

has been boiled and cooled in a kettle or covered saucepan. If desired, a tablet of euflavine can be added to a cupful of this water (see page 74). Remove any foreign bodies that come away easily, **but never probe a wound**. Apply a dry, sterile dressing, and re-dress the wound daily.

vii) Transfer patient to care of a **doctor as soon as possible**.

SPECIAL WOUNDS

1. BITES

Dog-bites are small puncture wounds, and should be eated by covering with a dry dressing and referring the ase to a doctor. **Rabies** or **hydrophobia** has now been amped out in this country. At any rate, nothing is to be ained from cauterising the wound and applying a ourniquet. Rabies infection, when present, does not avel by the blood-stream as does snake-poisoning, but by ay of the sheaths of the nerves. The disease takes about x weeks to develop, and it is for the doctor to decide on eatment, whether it be for rabies or for lockjaw (tetanus) fter a bite or scratch of a dog, cat, or other mammal.

Snake-bites in this country are inflicted by adders or pers. The venom is injected into the skin through two nall holes made by the poison fangs of the upper jaw of e snake. This poison is rapidly absorbed in the circulaon, causing fainting, sweating, vomiting, and even death young or debilitated persons. In addition, there is uch swelling and pain at the site of the bite.

First aid treatment for a bite on the hand or foot is:

(i) **Hang the limb down** and immediately apply a triangular bandage, necktie, or handkerchief as a **tourniquet** on the heart side of the bite just tight enough **to congest the veins** and stop the flow of poison to the general circulation. There is no need to stop the arterial flow (Fig. 101). Keep tourniquet on for half an hour.

(ii) **Suck the wound** to extract the poison and encourag bleeding: get patient to do this, if possible. Spit ou the poison, though it will do no harm if swallowed.

(iii) Keep the **patient absolutely at rest** as movement encourage the spread of venom in the body.

(iv) **Bathe the wound** with water made dark red with permanganate of potash to neutralise any poison in the surface part of the bite.

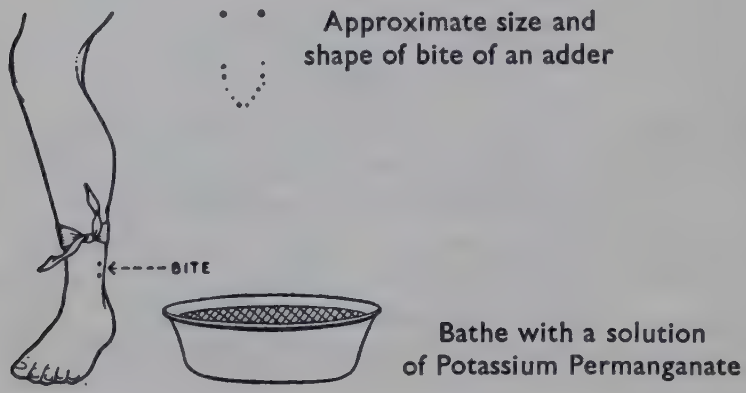


FIG. 101.—FIRST AID TREATMENT FOR SNAKE-BITE

Hang limb down and tie bandage around to congest veins and stop the flow of poison to the general circulation

(v) Give hot coffee or tea, and keep patient warm to avoid or lessen **shock**.

(vi) Send for a **doctor** or take patient to the nearest doctor or hospital.

(vii) Should breathing fail, apply **artificial respiration**.

2. BLISTERS

A blister is a collection of serum in the upper layer of the skin, and is due to friction such as from a bad-fitting shoe, or to a burn, or to a chemical irritant such as mustard gas.

To prevent blistering of feet. **Boots** should fit well, have fairly supple soles and not too stiff uppers. There should not be any large seams inside. If the leather is

ard, it should be softened by soaking in oil a week or o before the boots are required.

Thick socks should be worn for long walks or marches. hey should not be lumpy, and should have few seams. hey should fit the foot, be free from holes, and preferably ree from darns.

The feet should be washed every night, dried well, ubbed over with methylated spirit, and powdered between he toes with talcum.

A useful way of preventing blisters is to apply a lubricant etween the foot, sock, and shoe, at pressure points. To lo this, take a piece of moistened soap and rub it on the

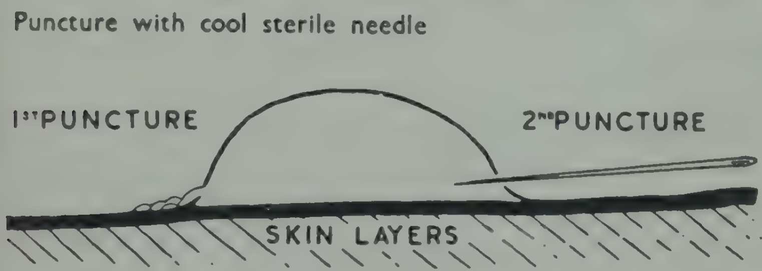


FIG. 102.—TREATMENT OF A SIMPLE BLISTER

kin over the heel and toes. Put on the sock, and rub oap on the outside of it over prominent points of toes and eel before putting on the shoe.

First aid treatment of blisters. If a doctor is vailable, the feet should be washed ready for his inspecon, as an infected blister may lead to serious consequences, ich as blood poisoning.

If a doctor is not available:

(i) **Wash** the foot with soap and water.

(ii) **Dry** and rub over with **methylated spirit**.

(iii) **Flame** the point of a **needle** until it is red hot, then allow to cool, taking care that it does not touch anything meanwhile.

(iv) With the point of the needle, **puncture the blister** on either side just above where it joins the normal skin (Fig. 102).

(v) **Press the blister gently** with a cotton-wool or gauze swab to empty it.
(vi) Apply a **clean dressing**.
(vii) **Never remove the blistered skin**, which helps to keep out infection.
(viii) If **further walking** is necessary, cover the blister with a piece of adhesive plaster or a layer of collodion (new skin).

Burn, corrosive, or gas warfare blisters should never be punctured. They should be anointed with anti-burn or anti-gas ointment, if available, or covered with a dry sterile dressing and the patient transferred quickly to the care of a doctor (see Chapter XIII).

3. **BRUISES** are due to bleeding under the skin and have been dealt with in Chapter VI, at page 49.

4. **CUT THROAT** may be homicidal or suicidal. The wound is of the incised type, and varies in extent and depth in different cases. In some, a short cut in the middle of the neck may divide the windpipe and gullet, in others, a cut from 'ear to ear' may divide little more than the skin and superficial veins. The majority of cut-throat wounds do not involve the carotid arteries or jugular veins, though they may divide large veins or branches of the carotid arteries. If the larger blood-vessels of the neck are divided, death is likely to occur almost immediately.

The main dangers in a case of cut throat are from profuse bleeding, suffocation, and shock.

First aid treatment

(i) Send for a **doctor** and **ambulance**.
(ii) Keep the patient's **head and neck raised**.
(iii) Apply direct **pressure with the thumb and a pad** to the wound to stop haemorrhage.
(iv) **Compress** the carotid artery at **the pressure point** just below the Adam's apple. See under treatment of external haemorrhages, page 40.
(v) Treat for **shock**: wrap up the patient and keep him warm, and raise his legs.

i) **If the windpipe is divided** do not cover up the wound as the patient must breathe through it.

THE EYE. Injuries to the eye are serious and should be mmediately referred to a doctor or hospital. First aid nsists of applying a pad and bandage to the eye as dicated in Figs. 61, 84, and 85.

A FISH-HOOK is difficult to extract from the skin, as the rbed end cannot be withdrawn without tearing the sues. Moreover, fish-hooks are usually heavily conminated with organisms so that sepsis is likely to follow.

Send the case to a doctor, if practicable ; if not —

(i) **Cleanse with antiseptic** (euflavine) around the wound area and the projecting portion of the hook.
ii) **Cut away** all but the metal part of the hook.
ii) Push the point and **barb of the hook** out through the skin. **Never try to withdraw the barb.**
v) **Break off the barb** (Fig. 103).
v) **Withdraw the hook.**
vi) Apply **euflavine** dressing.
ii) Send the case to a **doctor** as soon as possible.

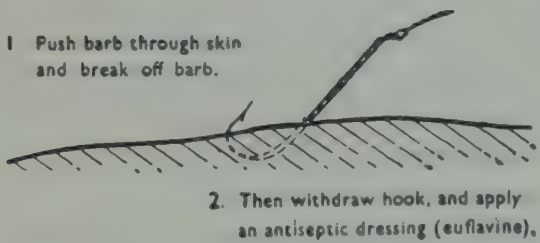


FIG. 103.—REMOVAL OF FISH-HOOK

INSECT STINGS. Bee and wasp stings are the chief ones countered in this country. They cause immediate pain d swelling around the area of the sting, but the poison dom gets into the general circulation, so that serious nsequences rarely occur unless the sting is on the lips or the mouth.

First aid treatment

(i) **Remove the sting**, if possible, with a pair of forcep or tweezers, or by pressing the hollow end of a sma key over it.

(ii) Apply **methylated spirit** to the sting, followed by

(*a*) diluted ammonia (1 part of ammonia to 4 par of water) or soda (a teaspoonful of bicarbonate c soda or baking soda to a cup of water) for be stings — **'bicarbonate for bee'**;

(*b*) vinegar in the case of wasp stings — **'vinegar for wasp'**.

(iii) Guard against **shock** by laying patient down an keeping him warm with blankets and hot drinks.

(iv) If the sting is **in the mouth**, get a **doctor** quickly o **send patient to hospital**.

8. **JOINTS AND TENDONS.** Should a wound open into joint or cut a tendon, the first-aider should do no mor than cover the wound against the entry of germs with sterile dressing and immobilise the part, using splints i necessary. Such cases must be transferred to hospital a quickly as possible.

9. **MACHINERY** is often the cause of very bad laceratec wounds and crushing. At times limbs are nearly or com pletely torn off.

First aid measures

(i) **Stop haemorrhage** immediately.

(ii) **Wrap the wounded part in a clean towel** or large roll of lint with a good covering of cotton-wool

(iii) Bind with a **firm bandage.**

(iv) **Support the injured limb** — if an arm, by a sling or, in the case of the lower limb, by raising it o pillows.

(v) Apply **anti-shock** measures.

10. If a **NEEDLE** breaks off in the skin, take the patient t the doctor or hospital. The portion of needle which ha

broken off should be taken to show the doctor. Never try to extract an embedded piece of needle or wire, as there is great danger of it passing in further.

Where a needle has been extracted whole, all that is necessary is to clean the surface of the wound with soap and water followed by methylated spirits. If the needle were rusty or dirty, the case should be referred to a doctor.

1. **SCALP WOUNDS** tend to bleed freely. It is inadvisable to cut the hair round the wound, especially in the case of girls and women: it is better to leave a doctor or trained nurse to do this. In fact, scalp wounds are serious, even when small, as infection may pass into the scalp and brain. All such wounds should be referred to a doctor as soon as possible.

First aid consists in arresting haemorrhage, applying a dry dressing, and transferring the case for skilled medical attention.

CHAPTER XIII

BURNS AND SCALDS

BEFORE considering burns it is necessary to have some idea of the structure and functions of the skin.

THE SKIN

The skin forms a protective covering for the body and fulfils several important functions. It is a **barrier to germs,** and helps to **regulate the temperature** of the body by evaporation of sweat and by the amount of blood in its network of blood-vessels. It conveys to the brain the **sensations of touch**, pressure, pain, cold, and warmth by means of sense organs embedded in it. Directly under the skin is a layer of fat, which varies in thickness in different individuals. This fatty layer acts as a **blanket to help maintain heat**, as a **padding to protect** the underlying muscles, nerves, and blood-vessels, and as a **store of food** for emergency.

The thickness of the skin varies; it is thicker on the back than on the front of the body; it is thickest on the soles of the feet and palms of the hands and on the scalp. Whatever its thickness, the skin is composed of two layers — superficial and deep skin (Fig. 104).

(i) The superficial skin, called the **cuticle** or **epidermis** is relatively thin, transparent, tough, and waterproof. It consists of layer upon layer of cells, the upper ones being constantly worn away by rubbing and as constantly replaced from the deeper cells. Excessive friction or burning causes an oozing of serum from the underlying blood-vessels: this serum collects between

the layers of the superficial skin and forms a blister (see pages 126–127).

(ii) The deeper layer, called the **true skin** or **dermis**, is elastic and much thicker than the superficial skin. It contains:

(*a*) Innumerable **sweat glands** which open as minute **pores** on the surface of the skin.

(*b*) In most places, except in the soles and palms, there are **hair roots** supporting the body hairs, which

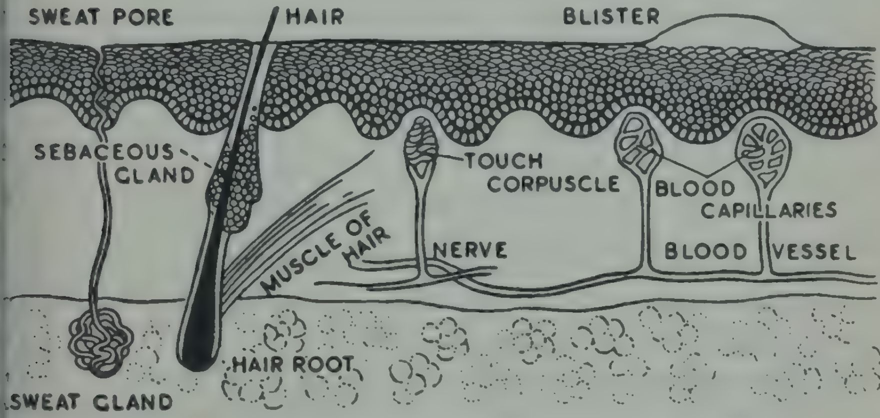


FIG. 104.—DIAGRAMMATIC SECTION OF THE SKIN

vary in length in different parts. These give a certain amount of protection against temperature changes and are sensory to some degree.

(*c*) **Oil or sebaceous glands** open round the hairs and help to maintain the waterproofing of the skin. This oil may be removed in excess in certain industries, such as those dealing with petrol, paraffin, acids, and alkalies, and this may lead to **dermatitis**. Protective or **barrier creams** are used in such industries to prevent the natural oil of the skin from being removed.

(*d*) **Nerve-end organs** (touch corpuscles) are present just under the skin. These are very sensitive to touch, pressure, cold, and heat. They are more

numerous in some areas than in others, so that burns of certain parts cause more shock than those of other parts.

(*e*) **Capillary blood-vessels**, arising from blood-vessels at the bottom of the deep skin, lie just under the superficial skin. These capillaries are in the form of minute coils like radiators in a heating system, and act as little radiators to regulate the amount of heat given off or retained in the body as they dilate or contract.

In burns it is very important to cover the raw skin to lessen shock to the nerve-endings and loss of heat from the exposed blood-vessels, also to keep germs out, as the protective layer is gone or damaged.

CAUSES OF BURNS

Injuries caused by heat are termed burns or scalds: the former is a roasting, and the latter a boiling, of the tissues.

1. **A burn** may be caused by —

(i) **Dry heat**, such as fire, hot or molten metal, unprotected hot-water bottles, the flash of ignited petrol or bursting bombs, especially those of the atomic and incendiary type.

(ii) **Electricity** or lightning (see pages 21–23).

(iii) **Corrosive chemicals** —

(*a*) **Strong acids**, such as nitric and sulphuric (oil of vitriol).

(*b*) **Strong alkalies**, such as ammonia, caustic soda, and quicklime.

(*c*) **Poison gases**, such as mustard gas.

2. **A scald** may be caused by boiling water, steam, boiling cooking fat, hot oil, or tar.

DEGREES OF BURNS

Burns and scalds may produce extensive wounds, the severity depending on the amount of heat and the length

of time for which it is applied, and on the strength of the chemical in the case of an acid or alkali. Children and those in lowered health are affected most by the shock which follows a burn or scald.

In medical text-books burns are classified into six degrees of severity, but for first aid purposes these can be divided into two types, namely, superficial and deep.

(i) In **superficial burns** there is a marked reddening of the skin and the formation of blisters. The amount of shock from a superficial burn is as great as that from a deep one, as the shock and pain are in proportion to the area of the skin surface involved, the reason being that the sensitive nerve-endings are situated in the skin (see Fig. 104).

(ii) In **deep burns** the skin is completely destroyed, and in severe cases there is destruction of blood-vessels, nerves, muscles, and maybe even of bone.

EFFECTS OF BURNS

The chief dangers resulting from burns are shock, pain, sepsis, and scarring.

1. **Shock** is present in all cases of burns, the degree varying with the area of skin and the part of the body involved. If a third of the skin's surface is burned, death is likely to occur. Burns of the face, neck, chest, and abdomen lead to more shock than those affecting the limbs. The mental strain under which the patient is labouring intensifies any shock, so that burns received during air-raids are often followed by more shock than under normal circumstances. Primary shock at the time of injury is usually recovered from, but secondary shock, which is liable to occur any time up to six hours after the injury, is very serious and often fatal (see Chapter III on Shock).

2. **Pain** is acute and in proportion to the area of skin affected. It is rendered worse by exposure to the air; that is the prime reason why burned areas under the

clothing should not be exposed and those that are — such as face or arms — should be covered as rapidly as possible.

3. **Sepsis** is very apt to occur in wounds caused by burns, owing to the lowered resistance of the raw surface to germs and opportunities for their growth in the damaged tissues. This infection is liable to spread and cause general blood poisoning **(septicaemia)**.

4. **Scarring** follows burns and is very disfiguring, so that skin grafting has often to be undertaken to complete the healing. The earlier the grafting is done, the less is the scarring. Skin grafting cannot be done successfully as long as there is sepsis. It is important, therefore, for the first-aider to appreciate this fact and do everything possible to prevent infection of a burn while attending it.

FIRST AID TREATMENT OF BURNS

First aid treatment consists of removing the victim from the fire, extinguishing any burning of clothes, counteracting shock, relieving pain, preventing sepsis, and arranging for his transportation to hospital as speedily as possible before secondary shock occurs.

1. **Removal from the fire** depends on the circumstances of the case.

(i) In a **burning building** the rescuer has to face the hazard of smoke, fire, and the suffocating gases — carbon dioxide and carbon monoxide — which accompany combustion (see Suffocation by Gases, at pages 60, 64–66). In addition, any burning of the clothes of the victim has to be extinguished rapidly, and he must be removed to the fresh air quickly.

(ii) In **air-raids**, casualties are often buried under burning debris in basements where gas mains may be ruptured, so that they may suffer from severe crush injuries as well as suffocation from the gas. Moreover, inhalation of the hot air from flames or escaping steam is liable to cause severe damage to the air-

passages, leading to swelling of their linings and subsequent suffocation. Remember that neither a wet handkerchief over nose and mouth nor even a gas-mask gives protection from that deadly gas — carbon monoxide. The approach to such cases is similar to that for those in burning buildings in general, but the hazards are much greater (see pages 65–66).

(iii) **Clothing on fire** requires prompt attention, otherwise the flames will spread rapidly. The victim is often in a panic and runs about: this fans the flames. Quickly lay him down flat with the flaming side uppermost, using force if necessary. If the burning side is underneath, the flames will spread upwards to the rest of the clothing. Try to smother the flames with a mat, coat, blanket, or rug and roll it round the victim. If water is available, throw a basin or bucketful over the burning area.

2. **Shock** is the most serious factor in cases of burns, and must receive priority of treatment. It may cause sudden death shortly after a severe burn, especially if the patient is handled and exposed much. The patient should be kept warm, and, to this end, all clothing should be left on, except that which is charred. Clothing which is sticking to the burn should not be removed. Exposed burnt skin should be covered with sterile dressings immediately to exclude the air and so lessen pain, shock, and the risk of infection. The patient should be given hot drinks, and handled with all gentleness as detailed in Chapter III on Shock.

3. **Pain** is great with a burn, and the first-aider's contribution to its relief is to keep the patient's wounds covered and move him as little and as gently as possible. When the doctor arrives, he will give morphine, if necessary, to allay the pain and so lessen shock.

4. **Prevention of sepsis** during first aid treatment is most important. The sooner a burn is covered with a

sterile dressing, the less is the chance of its becoming infected. A dry dressing should be used for preference in first aid work, as any infection present is apt to be spread by moisture. Before applying a dressing to a burn, the first-aider should wash his hands thoroughly and wipe them dry on a clean towel. To prevent germs entering burns by droplet infection from the nose or mouth, those dressing them should refrain from talking during the process, unless they are wearing masks of gauze four layers thick. Burns do not need any cleaning, as the heat which has caused them will have sterilised the skin. **Burn blisters must not be opened.** Special burn dressings should not be applied, except under a doctor's direction.

5. **Transportation to hospital** of all severe cases of burns should be arranged at once, as plasma transfusions and other special treatment are often necessary to combat the secondary shock. There is but a short time before secondary shock develops, say half to one hour, so that an ambulance should be summoned right away in the hope that it will arrive by the time the first aid treatment just outlined has been completed. The patient should be transported flat on a stretcher, and, to indicate the need for urgent attention, marked with a large X either on a label attached to his coat or on his forehead, using an indelible pencil or lipstick. Even among severe air-raid casualties, burn cases are given priority in transportation and treatment.

TREATMENT OF SPECIAL TYPES OF BURNS

1. **Burns due to corrosive chemicals** usually occur in laboratories and workshops where such chemicals are in use. Here the first aid room and cupboards should be stocked with materials to deal with these cases. Every case should be treated immediately, as follows:

(i) **Dab away** (not wipe) as much of the chemical as possible.

(ii) Remove or cut away **contaminated clothing**.

(iii) **Thoroughly flood** the affected part **with water** to dilute the chemical, then —

(iv) Apply a **suitable antidote**, if available, for five minutes; for example:

(*a*) If a **strong acid** is the cause of the burn, sprinkle it heavily with powdered sodium bicarbonate (baking powder).

(*b*) If a **strong alkali** has caused the burn, sprinkle the part with powdered boracic acid or flood it with vinegar.

(v) Then, apply a **sterile dressing** and treat as for an ordinary burn.

2. **Electrical burns** occur from contact of the bare skin with live electric currents in wires, cables or rails, or from lightning stroke, as has been described on pages 21–23. First aid treatment for electrical burns is the same as that for an ordinary burn, except that artificial respiration may have to be carried out first and while the burns are being dressed.

3. **Eye burns** occur in certain trades where strong acids and alkalies are used. The commonest causes are sulphuric acid spluttering in the eye, as with those engaged in filling wet electric batteries, and quicklime blowing in the eyes of builders. In chemical works where strong acids and caustics are used, special eye-wash solutions have to be provided under the Factories Act of 1937.

(i) **If acid gets into the eye:**

(*a*) Immediately flush it **thoroughly with water** squeezed out of a moist handkerchief or a cotton-wool swab. If a wash-bottle is available, hold the lids apart and pour a steady stream of water or alkaline solution over the eyeball.

(*b*) Follow this up by bathing the eye with a 2 per cent solution of **bicarbonate of soda** (a teaspoonful of baking soda to a tumblerful of warm water).

(*c*) Then **apply an eye-pad** and bandage, firmly but lightly (see Figs. 61, 84, and 85).

(*d*) Get a **doctor** to see the case as soon as possible, no matter how trivial the eye injury appears.

(ii) **If an alkali gets into the eye** (*e.g.* quicklime):

(*a*) Immediately flush the eye with water or **diluted vinegar** (one part of vinegar to four of warm water), or, if stocked, a 1 per cent solution of acetic acid.

(*b*) Apply **pad and bandage.**

(*c*) Refer case to a **doctor** as soon as possible.

4. **Burns of the face** are most commonly due to the flash of burning petrol, as from stoves, and in motor-car and

FIG. 105.—DRESSING FOR BURN OF FACE

aircraft crashes, though some are due to ordinary fires or to corrosive chemicals (as in vitriol throwing). They are particularly painful and should be covered quickly, except corrosive burns which must be treated and neutralised as at pages 138 and 139.

(i) Take a triangular bandage and **cut slits for eyes and mouth** (see Fig. 105).

(ii) Smear a little **vaseline** around lips and eyes only.

(iii) **Apply a bandage** either dry or after soaking in baking soda solution (a teaspoonful of baking soda to a tumblerful of water).

(iv) **Tie ends off** at the back of the head.

If preferred, a face-mask can be made with sterile lint and tapes as shown in Fig. 106. These masks can be

stocked in a sterile container at first aid posts, but for the odd case the triangular bandage method is the simpler.

5. **Burns or scalds of throat and mouth** occur usually in children through drinking boiling water from the spout of a kettle or in suicide cases from swallowing a corrosive fluid. The condition is very serious, as there is much swelling of the throat, which may lead to suffocation.

(i) Send for a **doctor at once**.
(ii) **Lay patient down** in a warm room and keep him warm as there is great shock.

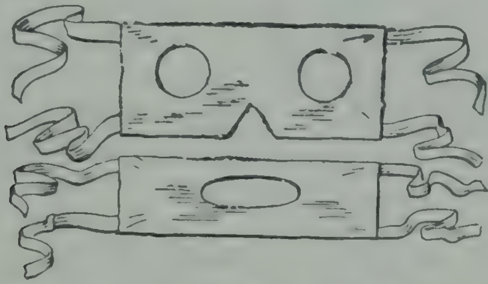


FIG. 106.—TWO-PIECE MASK FOR BURN OF FACE

(iii) Wring out a **towel in cold water**, and apply to patient's neck.
(iv) Give **sips of cold water**.
(v) If a corrosive has been swallowed, **never give an emetic** (see Chapter XXI on Poisoning), but give a weak alkali drink if acid has been swallowed, or a weak acid in the case of alkali poisoning.

. **Air-raid burns** may be of five kinds — flash from the xplosion of all types of bombs, phosphorus from in-endiaries, chemical from gas warfare, radiation from tomic bombs, and ordinary from the burning buildings.

(i) **Ordinary and flash type of burns** should generally be sent to hospital as soon as first aid and anti-shock treatment has been given at the first aid post or point. Cover the wound with a sterile dressing, keep the patient warm and quiet, and give him hot, sweet tea.

Reassure him, and, if in the open, allay his fears c
danger by providing shelter of some kind, howeve
flimsy it may be, against blast or missiles.

Some first aid posts may be organised unde
medical supervision to apply more elaborate bur
dressings than dry gauze or dry euflavine-impregnate
gauze to selected cases in order to lessen the strain c
work on the hospitals. If so, the dressings of choic
are sulphanilamide powder, penicillin, tulle gras, an
'No. 9 Cream', but not
that tannic acid, gentia
violet, or triple-dye jell
must never be used: the
are harmful.

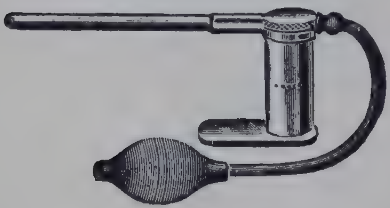


FIG. 107.—STERILISABLE POWDER DUSTER

(*a*) **Sulphanilamide powder or penicillin** ma
be dusted from a specia
sterile container on to th
burnt area, before applying the dressing. Thi
treatment helps to prevent sepsis, and is usefu
for cases whose admission to a hospital is delaye
(Fig. 107).

(*b*) **Tulle gras** consists of sterilised gauze impregnate
with sterilised vaseline and balsam of Peru. It i
usually provided in airtight tins, each dressin
being 6 inches square which facilitates applicatio
and removal bit by bit. This is a sterile an
soothing dressing.

(*c*) **No. 9 Glasgow Cream** is the application o
choice as it contains sulphanilamide as an anti
septic and cetavlon as a cleansing agent, and it i
readily removed by water. It should be sprea
on sterile gauze or lint by means of a clean knif
or spoon, which has been made sterile by boilin
for 5 minutes or heated in a flame. These crean
dressings are applied direct to the burn withou
any cleaning of the part, covered with a goo
layer of cotton-wool, and bandaged on gently bu

firmly. When a burn is dressed with strips or squares of gauze or lint, these should overlap one another to facilitate removal and reapplication without exposing the whole burn at one time, so lessening shock and the risk of infection. In the case of phosphorus burns, **this cream must not be applied until all the phosphorus has been removed** as checked by the absence of phosphorescence in the dark, as the oil will dissolve phosphorus and cause poisoning.

(ii) **Phosphorus burns** are particularly dangerous, as the phosphorus continues to burn as it dries on the skin or in the eyes.

(*a*) **Flush with water at once** to extinguish the burning phosphorus — try to wash it all away.

(*b*) Apply a clean **dressing soaked with water**. It must be kept wet, otherwise it may burst into flames if any phosphorus remains.

(*c*) Evacuate case to **first aid post or hospital** at once.

(*d*) Mark forehead or an attached **label with a P** to indicate phosphorus burn and to ensure immediate attention at the hospital.

(*e*) **Never apply any dressings other than water ones to a phosphorus burn.** Oils would cause solution of the phosphorus and consequent poisoning, and dry dressings would go on fire.

ii) **Gas-warfare burns** may occur as the result of contact with liquid or vapour, chiefly of **mustard gas and lewisite**, put down in the form of bombs or sprayed from aircraft. On first contact with mustard gas a faint smell of garlic will be noticed. The gas does not cause immediate irritation, so that it is important to recognise it by the smell. It affects the skin, eyes, and the respiratory system, causing redness and blistering. Lewisite has a faint smell of geranium, but unlike mustard gas its effects are immediate. If it enters the eye, there is severe pain and spasm. On

the skin it causes stinging at once followed by redne and blistering. It is absorbed through the skin an causes severe damage to the liver, kidneys, and oth organs.

First aid treatment

(*a*) **If the eyes are affected, flush them ou immediately with water.** If only one eye affected, be careful not to let the wash wate enter the other eye. In the case of lewisite, ant arsenical solutions are provided.

(*b*) **Remove grossly contaminated clothing.**

(*c*) **Dab off** any oily fluid on the surface of the skin.

(*d*) If the skin is not blistered or reddened, gentl rub on **anti-gas ointment No. 2** (or if not avai able, chloride of lime) until a faint smell c chlorine is given off, showing that the gas ha been neutralised.

(*e*) **Smear on a little more** ointment and leave fo 5 minutes.

(*f*) Rub off the ointment and **wash thoroughly** wit warm water.

(*g*) Then **treat** the case as an **ordinary burn.**

(*h*) **Never open a gas blister.**

(iv) **Atomic bomb** explosions may injure man in thre ways — by flash burning, blast effects, and radio activity. When an atomic bomb explodes, it emit radiations of various kinds, extending from infra-re rays through visible light and ultra-violet to radiur rays. The burning radiations are gone in a flash, bu they can affect the exposed skin of all persons withi an area of a couple of miles. The least bit of covering building or clothing, even of the flimsiest nature, give protection. The exposed skin of individuals within quarter of a mile of the burst is likely to be turne brown or black, and they will probably die in a sho time, even if not otherwise injured. Those at great distances, up to two miles or so, are liable to suff from superficial burns like severe sunburn, with c

without blistering. All these burns are very painful, and the shock is considerable.

The first aid treatment is the same as that for burns in general, except it would probably have to be more complete at the first aid post, as any radio-active contamination of the ground would prevent cases being evacuated to hospital for some time.

The effect of blast is dealt with in Chapter XXIV, at page 275.

Summary of first aid treatment for burns in general

If the burn is severe or extensive, wrap up the patient to maintain warmth, and transport him to hospital as soon as possible. Otherwise

(i) **Give anti-shock treatment** —
  (*a*) lay patient down;
  (*b*) wrap him well to keep him warm;
  (*c*) give hot drinks of sweetened tea or coffee;
  (*d*) handle patient as gently and as little as possible;
  (*e*) never remove clothing, unless soaked with corrosive or petrol.

(ii) **Exclude air and germs** by applying sterile dressings. These should be made of gauze or lint, and applied either dry or soaked in water or bicarbonate of soda solution (a teaspoonful of soda to a tumblerful of warm water).

(iii) **Get a doctor or transport to hospital** as soon as possible.

(iv) **Never open a burn blister.**

(v) **Do not try to clean a burn.**

(vi) **Do not apply tannic acid** or other chemical solutions or ' burn jellies '.

CHAPTER XIV

THE SKELETON

THE word 'skeleton' denotes the bony framework of th body. It serves to support the soft structures, affor protection to the internal organs, forms a series of leve

	Number of Bones		
	Single	Pairs	Total
The skull	6	8	22
The spine	26	..	26
The chest-wall (breast-bone and ribs) . . .	1	12	25
Two upper limbs . .	..	32	64
Two lower limbs . .	..	31	62
The hyoid bone . . .	1	..	1
Three small bones in each ear (ossicles) . . .	..	3	6
			206

which enable the limbs and the whole body to mov and plays an important part in the formation of bloc corpuscles.

1. **Structure of a bone.** All bones are composed similar constituents, namely—

(i) a thin outside membrane, called the **periosteu** which covers the bone and fits tightly round it;

(ii) a hard outer layer, the **compact tissue**;

(iii) a central honeycombed and softer portion, the **ca cellous tissue**; and

(iv) a fatty substance which fills the honeycombed spaces and the central cavity of some bones — the **bone marrow or medulla** (Fig. 108).

2. **Types of bones.** According to their shape, bones are subdivided into the following types:

Long bones as in the limbs.

Flat bones as in the skull and around the body cavities.

Short bones as in the wrist and ankle.

Irregular bones as in the face and the spine.

The various types of bones have different functions — the long bones serve mainly for locomotion; the flat for protection; the short for the joint movements of the hand and foot; and the irregular ones as a scaffolding or support. In all there are in the adult 206 bones, arranged as in the Table on page 146.

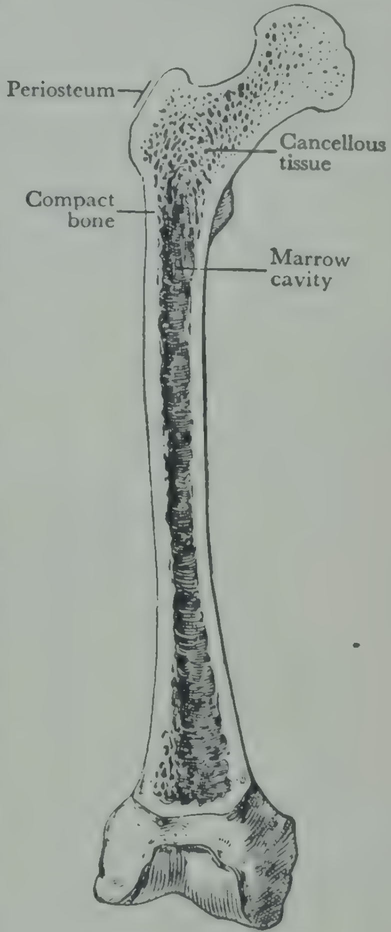


Fig. 108.—Section of Right Thigh-Bone (Femur) showing the Structure of the Bone

The shell is called compact tissue and the central part cancellous

. **Parts of a bone.** The long ones are composed of several arts:

(i) The **shaft.**

ii) The upper end, generally called the **head.**

ii) Various prominences which are given particular names such as condyles, spines, tuberosities, and trochanters. The ends of the bones are covered with a smooth tissue (gristle or **cartilage**),

so that there may be little friction at a joint. In th
young the ends of bones are joined to the shaft b
special cartilage. During this stage the end of th
bone is termed **epiphysis** (Fig. 109); most epiphys
are joined to the shaft betwee
17 and 21 years of age. Whe
all epiphyses are joined th
skeleton ceases to grow.

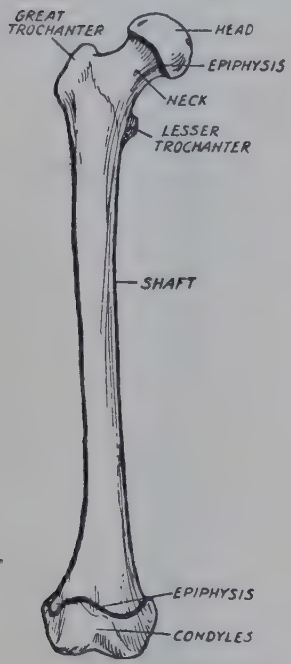


FIG. 109.—THE THIGH-BONE IN YOUTH

Each end of the bone is separated from the shaft by an area of cartilage, which is shown as a dark line in the diagram. The head and the lower end of the femur are epiphyses

THE SKULL

The head or **skull** consists of tw
parts:

The brain-case or **cranium**, com
posed of eight bones; th
protects the brain and th
organs of hearing (internal an
middle ears).

The **face**, composed of fourtee
bones, which protect the fo
lowing organs of special sense
the eyes, the tongue, and th
lining of the nose.

1. **Cranium** (Fig. 110)

(i) The bones of the top of the sku
or the **vault** are—

(*a*) The **frontal** or forehead.

(*b*) Two **parietal**, one on eac
side.

(*c*) Two **temporal** or templ
below the parietal bones.

(*d*) The **occipital** at the back of the head.

(ii) The bones at the **base** of the skull, below the brai
are the **ethmoid, sphenoid**, and parts of the **fronta**
temporal, and **occipital**. The base of the sk
rests on the **first vertebra** or **atlas**. There is a rour
hole in the occipital bone, the size of a halfpenn

called the **foramen magnum,** through which passes the spinal cord.

2. **Bones of the face** (Fig. 110)

There are fourteen bones in the face, the chief being:

(i) Two nose or **nasal.**
(ii) Two upper jaw or **superior maxillae.**
(iii) Two cheek or **malar.**
(iv) The lower jaw or **inferior maxilla** (mandible).

All the bones of the skull are united, with the exception of the lower jaw, which has a joint with the base of the skull near the ear. The teeth are set in the upper and lower jaws. The eye-sockets or **orbits** are about 2 inches deep and contain the eyeball with its muscles, nerves, and blood-vessels, surrounded by a protective cushion of fat.

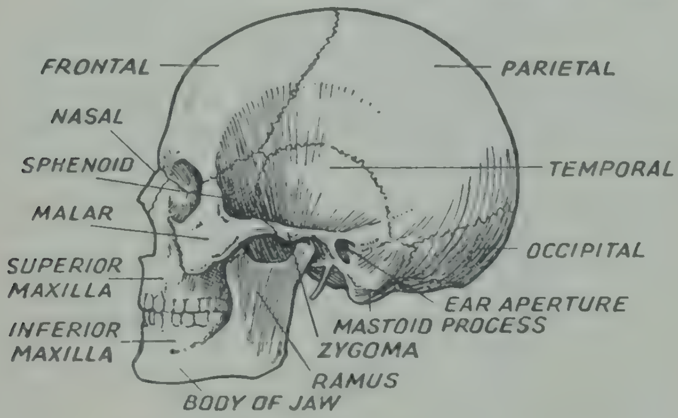


Fig. 110.—The Skull (side view)

THE SPINE (BACKBONE OR VERTEBRAL COLUMN)

The spine consists of thirty-three bones, called **vertebrae**; they form a column which supports the other parts of the skeleton.

1. **Each vertebra** (Fig. 111) consists of —

(i) A **body** in front, the shape of a disc.

(ii) **Transverse processes** at the side and **spinous processes** at the back. The latter can be felt down the middle of the back.

(iii) Between the body of a vertebra in front and the various processes behind is a hole; the holes of all the vertebrae form a canal which contains the **spinal cord.**

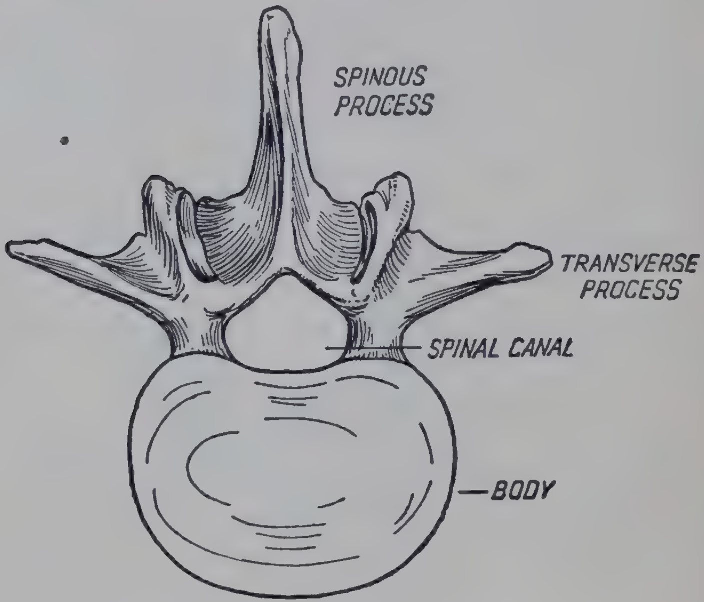


FIG. 111.—A LUMBAR VERTEBRA
Seen from above

Pads of gristle, called **intervertebral discs**, separate one vertebra from the next.

Bands of tough fibres, called **ligaments**, bind the bones together. There is a limited amount of movement between the vertebrae.

2. The **vertebral column** is subdivided into the following parts:

(i) The **cervical spine** (or neck) which curves forwards and consists of seven vertebrae (Fig. 112). The first is called the **atlas** and supports the skull. The second is called the **axis**. These two vertebrae enable the

head to turn sideways and to bend downwards, forwards, and backwards, as in nodding.

(ii) The **dorsal** or **thoracic** spine, which curves backwards and consists of twelve vertebrae, lying at the back of the chest. To each is attached a pair of ribs which fit in a small socket on each side of the vertebra.

(iii) The **lumbar** spine (loin), which curves forwards slightly and consists of the five largest vertebrae lying at the back of the abdomen.

(v) The **sacrum**, which curves backwards and consists of five vertebrae fused together into one bone; this forms the back of the pelvis.

(v) The **coccyx** represents the remnant of a tail and is formed by the four lowermost small vertebrae.

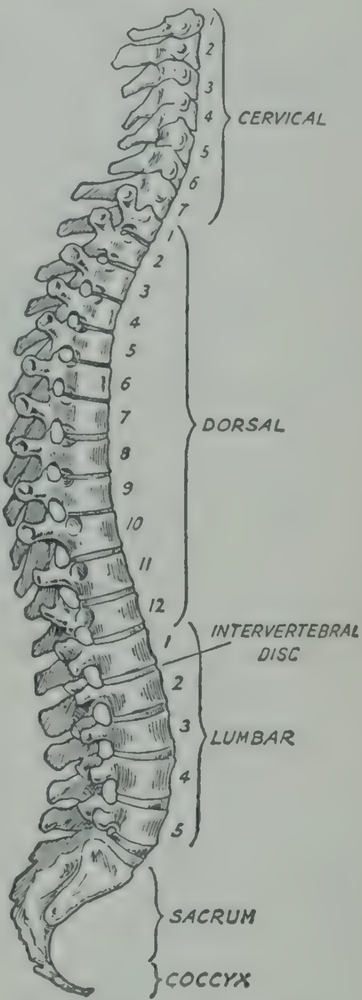


FIG. 112.—THE SPINAL COLUMN (SIDE VIEW)

THE THORAX

The chest or **thorax** is a dome-shaped cavity, having a wall formed of ribs and intervening muscles. The bony wall protects the lungs and heart and some of the upper abdominal organs (the liver, spleen, stomach). The dorsal vertebrae lie behind; the ribs extend round the sides and join in front with the breastbone or **sternum**, which is a dagger-shaped bone about

10 inches long in the adult. The **diaphragm**, the chief breathing muscle, separates the thorax from the abdomen (see Fig. 113).

The **ribs** are twelve in number on either side. They increase in length from the first to the seventh, then decrease to the twelfth. The upper seven pairs, the **true**

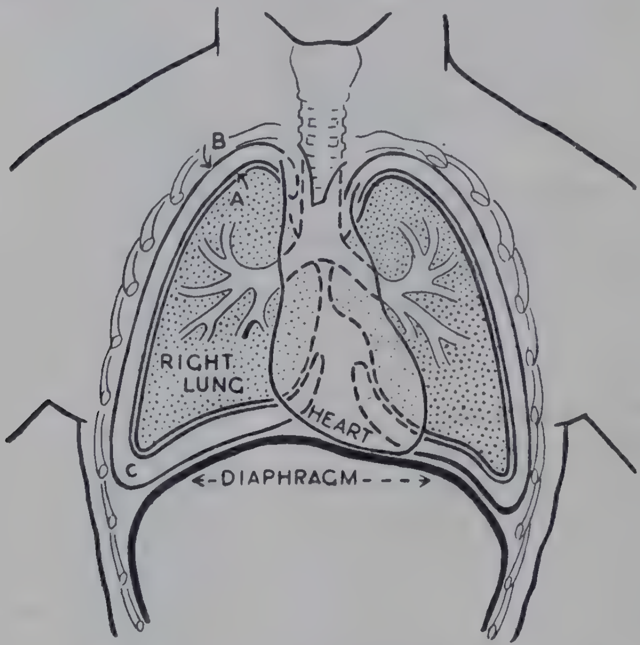


FIG. 113.—DIAGRAM OF DIAPHRAGM

ribs, are joined by cartilage to the sternum. The lowest five ribs do not reach the sternum and are called **false** ribs; the eighth, ninth, and tenth ribs are attached by cartilage to the ribs above them; the last two are free or floating ribs.

THE PELVIS (FIG. 114)

This is a basin-like mass of bone that contains and protects the bladder, the rectum, and the internal genital organs, and also provides sockets into which the thigh bones are jointed.

It is formed by the two **haunch bones** or **innominate**

bones, and the **sacrum.** The innominate bones meet in front at the **symphysis pubis,** where they are joined by a piece of cartilage.

Each **innominate bone** (Fig. 115) consists of—

1. The **ilium,** which is a flat bone, is curved and lies on one side of the pelvis. This has a prominent crest along the top, commonly referred to as the ' hip '.

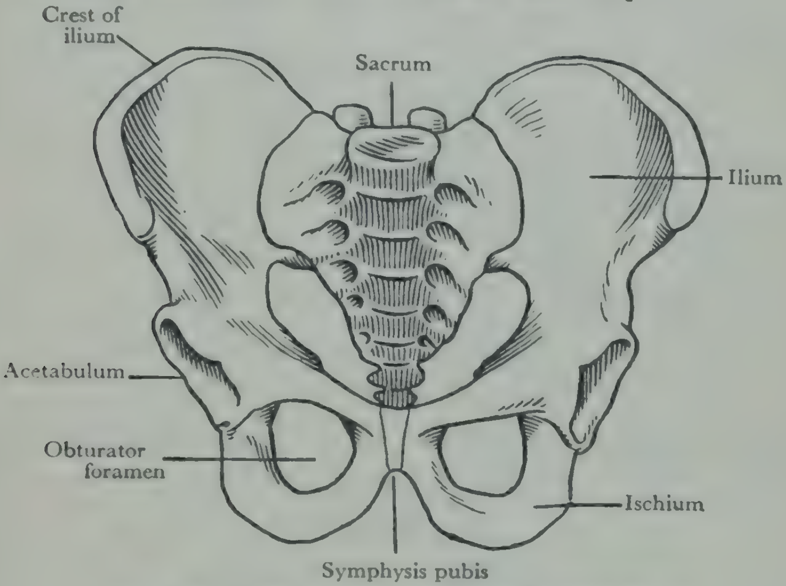


FIG. 114.—THE PELVIS (SEEN FROM THE FRONT)

2. The **ischium,** a strong V-shaped bone with a prominence on which one sits.
3. The **pubic bone** in front.

On the outer side of the innominate bone is seen the rounded hollow **(acetabulum)** into which fits the head of the **thigh-bone** or femur to form the bony part of the hip-joint (Figs. 114 and 115).

BONES OF THE UPPER EXTREMITY

The two collar-bones or clavicles with the two shoulder-blades or scapulae form the shoulder girdle.

1. The **collar-bone** or **clavicle** is a curved bone about as thick as the index finger, which can be felt under the

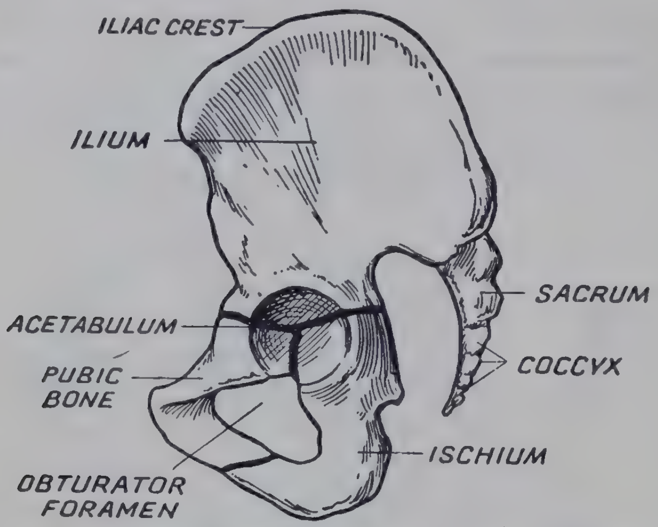


Fig. 115.—Haunch-Bone of a Child, showing Cartilage between the Component Parts

skin, extending from the side of the breast-bone (sternum) to the top of the shoulder, where it joins a process of the

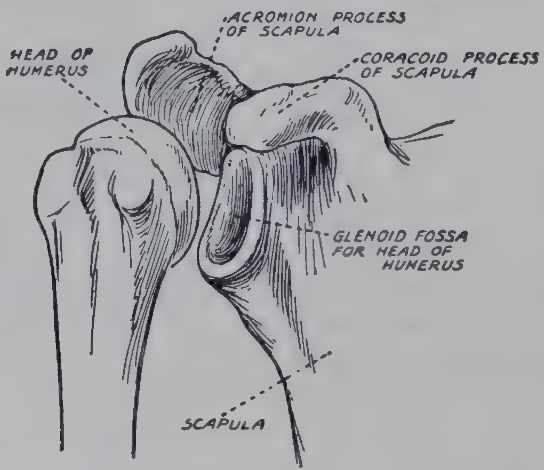


Fig. 116.—A Ball-and-Socket Joint (the Shoulder)

shoulder-blades (scapula). This bone is frequently broken by falls on the shoulder (Fig. 1).

2. The **shoulder-blade** or **scapula** is a flat, triangular-shaped bone lying behind the ribs at the outer and upper part of the back of the chest. It forms joints at its outer end with the collar-bone and upper arm-bone (humerus). The latter is termed the **shoulder-joint** (Fig. 116). Strong

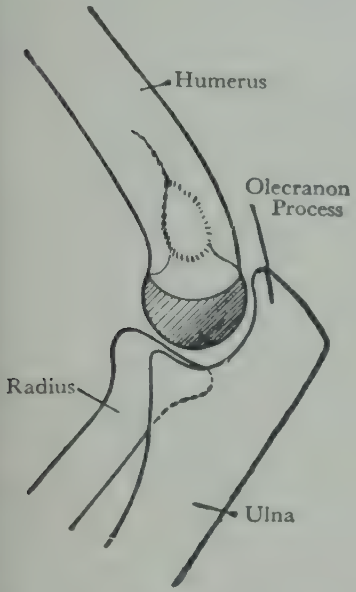


FIG. 117.—THE ELBOW-JOINT VIEWED FROM THE SIDE

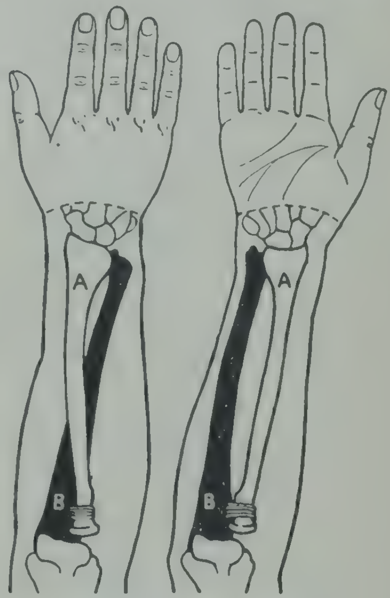


FIG. 118.—MOVEMENTS OF THE RADIUS AND ULNA
A, Radius
B, Ulna

muscles attach the scapula to the spinal column and the ribs.

3. The **arm-bone** or **humerus** reaches from the shoulder to the elbow. The upper end is called the head. The lower end of the shaft is shaped so as to allow free movement at the elbow-joint.

The forearm bones are the radius and ulna.

4. The **radius** is the outer bone. When the arm rests beside the body, with the palm of the hand facing forwards,

this bone is parallel to the ulna, and extends straight down on the thumb side of the limb.

5. The **ulna** is a thinner bone than the radius, and a little longer, owing to the enlargement at the upper end, called the olecranon or point of the elbow (Fig. 117). This lies behind the lower end of the humerus and forms part of the elbow-joint.

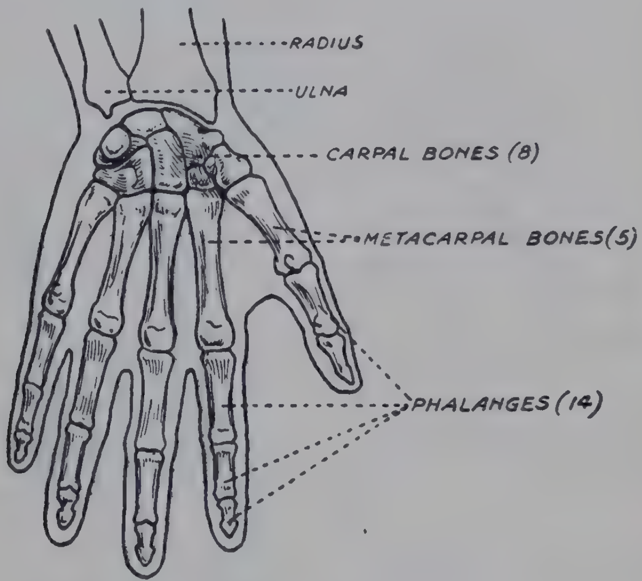


FIG. 119.—BONES OF THE WRIST AND HAND

The ulna lies along the inner side of the forearm. There is a joint between the radius and ulna at the upper end and at the lower end, so as to allow the radius to rotate on the ulna (Fig. 118). If the elbow is bent to a right angle and the palm of the hand faces upwards, the forearm is said to be supinated (Fig. 118 A). When the hand is turned over so that the palm faces downwards, the forearm is pronated (Fig. 118 B).

In the position of pronation the radius lies obliquely across the ulna. The movements of pronation and supination are of the utmost importance for the full use of the hand, and it is essential, therefore, that the bones should

be placed in correct position when either or both are fractured.

The **bones of the hand** (Fig. 119) are—

The carpus (wrist). The metacarpus (palm).
The phalanges (fingers).

6. The **wrist-bones** or **carpus** consist of eight small bones arranged in two rows of four; their shape and number give the wrist great mobility.

7. The **metacarpus** (the framework of the palm) consists of five bones reaching from the carpus to the knuckles.

8. The **finger-bones** or **phalanges** are arranged in rows as in the foot. There are two in the thumb and three in each finger.

BONES OF THE LOWER EXTREMITY

1. The **thigh-bone** or **femur** (Figs. 108 and 109) extends from the hip-joint to the knee-joint. It is the longest bone of the body. The upper end consists of—

(i) The head, which is rounded and fits into the acetabulum.

(ii) Two projections termed the greater and lesser trochanters, to which muscles are attached. They are separated from the head by the neck of the femur, through which fractures often occur in old people. The shaft broadens out at its lower end to take part in the formation of the knee-joint.

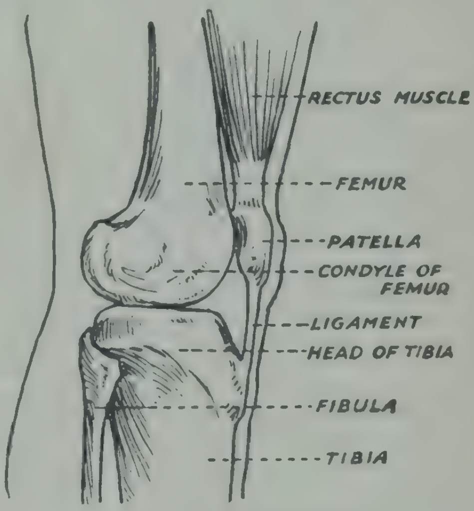


FIG. 120.—SIDE VIEW OF THE KNEE-JOINT

2. The **knee-cap** or **patella** is a thick triangular piece of bone situated on the front of the knee-joint, just under the skin.

The bones of the lower leg are the shin-bone or tibia and the brooch-bone or fibula (Fig. 120).

3. **Shin-bone** or **tibia** extends from the knee to the ankle (Fig. 1). It can be felt under the skin along the inner side of the lower leg near the front. The prominent border forms the shin. It is much larger than the fibula. It consists of the head, forming part of the knee-joint, the shaft, and the lower end. On the inner side of the lower end is a prominence called the internal malleolus, which forms the inner part of the ankle-joint.

4. The **brooch-bone** or **fibula** lies on the outer side of the lower leg. Its head joins the tibia just below the knee-joint. The lower end forms the external ankle-bone or malleolus.

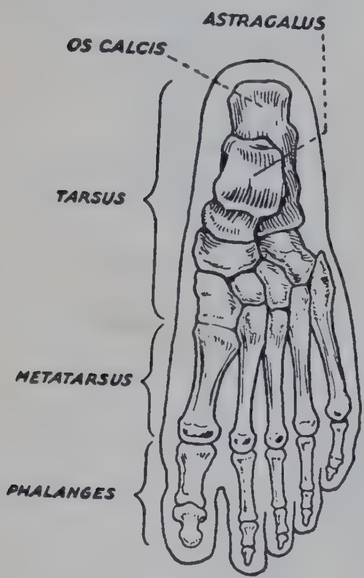


Fig. 121.—Bones of the Foot

The **bones of the foot** (Fig. 121) are—

The tarsus (ankle bones).
The metatarsus (sole of the foot).
The phalanges (toes).

5. The **tarsus** consists of seven bones, of which the heel-bone or **os calcis** is the largest. The **astragalus** is mounted on top of the os calcis and forms the lower part of the ankle-joint.

The other tarsal bones are arranged so that the body-weight is transferred comfortably to the foot. Together with the metatarsal bones they form the arch of the foot.

6. The **metatarsus** consists of five bones, one corresponding to each digit or toe, but they lie behind the toes and can be felt on top of the foot.

7. The **phalanges** or little bones of the toes are arranged in rows in front of the metatarsal bones. There are two in the big toe and three in each of the other toes.

CHAPTER XV

FRACTURES IN GENERAL

A FRACTURE is the name given to a broken bone, wheth
it be cracked, split into two pieces, or splintered.

CAUSES OF FRACTURES

1. **Direct violence.** When a bone is broken at the sp
where force is applied, the fracture is said to be caused b
direct violence.

Examples:

(i) A fracture of the skull from a direct blow on th
head.

(ii) A fracture of the tibia from a car wheel runnin
over a leg.

(iii) A fracture of the humerus from a bullet wound
the arm.

2. **Indirect violence.** When a bone is broken at
distance from the actual point of injury, it is said to b
caused by indirect violence.

Examples:

(i) A fracture of the base of the skull caused by a fall
the feet from a height.

(ii) A fracture at the wrist or elbow from a fall on the ou
stretched hand, although neither the wrist nor th
elbow actually hits the ground.

3. **Muscular action.** A fracture may be caused by
sudden violent contraction of a muscle with the limb i
a position that favours fracture. For example, a sudd
contraction of the thigh muscles when the knee is slight
bent may cause fracture of the knee-cap.

4. **Spontaneous fracture** is one which results from a trivial or slight injury or without an injury. It occurs when the bone is diseased, and is most common in old people.

VARIETIES OF FRACTURES (Fig. 122)

According to the condition of the tissues at the site of fracture, the following varieties are described.

1. **Closed or simple** fracture is one where there is no external wound allowing the air to communicate with the fractured ends of the bone. A common example is a fracture of the shin-bone when the skin is intact.

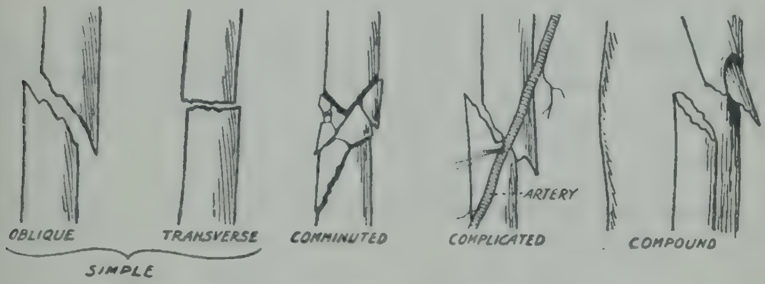


Fig. 122.—Various Types of Fractures

2. **Open or compound** fracture is one where there is a wound of the skin and soft tissues leading down to it.

Examples:

(i) A wheel runs over a leg causing a wound, and the broken ends of the tibia protrude through the wound (Fig. 122).

(ii) A bullet wound through the leg causes fracture of tibia and fibula; the entry wound of the bullet will cause a communication between the air and the fracture.

3. **Complicated** fracture is one where, in addition to the broken bone, there is also injury to an important blood-vessel or nerve; or a dislocation of the neighbouring joint. A complicated fracture may be simple or compound.

Examples:

(i) A fracture of a rib, when a fragment of bone is driven into the lung and injures it.

(ii) A fracture of the femur, when a jagged point at the site of fracture pierces the femoral artery.

(iii) A fracture of the humerus, when the fractured end cuts an important nerve running round the bone and causes paralysis of muscles in the forearm.

A simple fracture may become compound or complicated if, after the injury, the part is carelessly or roughly handled by the patient or the attendant.

4. **Complete** fracture is one in which the bone is broken right across. Self-explanatory terms are used to describe the shape of fractures, namely — transverse, longitudinal, spiral, oblique, stellate, T- or Y-shaped.

5. **Incomplete or greenstick** fracture (Fig. 123) is one where the bone is partially fractured and partially bent. It occurs in children, owing to the softer state of the bony tissues. This type of fracture is commonest in the clavicle and forearm bones.

FIG. 123.—GREENSTICK FRACTURE

6. **Comminuted** fracture is one in which the bone is broken into several pieces. These fractures are usually due to direct violence, produce extensive bruising, are more difficult to treat than simple fractures, and require more careful handling.

7. **Impacted** fracture occurs when one end of a broken bone is driven into the other. A fracture at the lower end of the radius (Colles's fracture) is often impacted. Crepitus is not found where the fragments are firmly impacted. If the first-aider thinks a fracture is impacted, he should avoid all manipulations, such as a pull on the hand or foot to bring it into place.

8. **Depressed** fracture is one in which a piece of the skull is broken and driven inwards. The depressed portion of bone may injure the brain, as described in Chapter XIX under the heading 'Unconsciousness' at pages 227 and 230.

SIGNS AND SYMPTOMS OF FRACTURES

The presence of a fracture may be recognised by the history, symptoms, and signs.

1. **History of Injury**
   - (i) Patient or onlookers may indicate the nature of the accident, such as a fall or a traffic mishap.
   - (ii) Clothing may be torn or marked with mud.
   - (iii) The snap of the bone may have been heard or felt.
2. **Symptoms**
   - (i) **Pain** and tenderness at or near the fracture.
   - (ii) **Loss of power** in the limb.
3. **Signs**
   - (i) **Deformity**, that is:
     - (*a*) The normal shape and outline of the limb may be altered (compare with other limb).
     - (*b*) The whole limb below the fracture may be in an unnatural position; thus the knee may be turned outwards and the foot rolled out.
   - (ii) **Swelling** may be present at or around the injury, owing to:
     - (*a*) Overlap of fractured ends.
     - (*b*) Bulge of muscles.
     - (*c*) Effusion of blood.
   - (iii) **Discoloration:** The bone bleeds where it is broken, and if the muscles and soft tissues are injured, further haemorrhage occurs into the limb. This may be seen soon after the injury, or it may not become visible for a few days.
   - (iv) **Shortening of the limb** may occur, if the bones overlap each other after the fracture. The heel may be seen at a higher level than that on the other side.

Measurement with a tape or piece of string will confirm this.

(v) The **fracture** may be **felt** if the bone lies closely under the skin. The broken end may be seen projecting through the wound in a compound fracture. The wound may be oozing blood.

The doctor alone should determine —

(vi) If **abnormal mobility** exists at the site of the fracture.

(vii) If **crepitus** is present — that is, a grating sensation due to the broken ends moving upon each other.

It must be clearly understood that all these signs and symptoms are not present in every fracture. As many signs as possible should be noted by simple observation of the limb, without pulling on the limb, which may cause pain or further damage. The injured and uninjured limbs should be compared if in doubt.

GENERAL RULES FOR FIRST AID TREATMENT OF FRACTURES

The object of first aid treatment is to **prevent further damage** from occurring; to **prevent pain**; and to make the patient as **comfortable** as possible, until deliberate treatment of the fracture can be carried out. These objects can be **achieved by immobilising the fracture**, that is, by fixing the limb so that the broken ends of the bone cannot move.

The less interference there is with a fracture at the incident and the simpler the treatment, the better. There is a tendency for the first-aider to try to do too much to relieve the condition. It should be remembered that every movement causes pain and shock, and that the application of splints to a fracture that has not been set may, if not properly done, cause additional pain and interfere with the circulation of blood to the part. The splinting of fractures, as described in Chapter XVI, is generally not essential in first aid work, where the aim

should be to pass the case on to a doctor or hospital for skilled attention, as soon as the patient is fit to be moved and the fracture has been immobilised. The first-aider, however, should have some knowledge of the use of splints, as he may have to assist a doctor or have to apply them himself when casualties have to be transported for long distances, especially over rough ground. Generally speaking, the simple methods outlined below are enough for injuries of the upper or lower limbs, whether the condition be a fracture or doubtful fracture (*i.e.* dislocation or sprain).

1. **First aid for simple fractures**

(i) Quickly place the patient in a **comfortable position** with the **injured part well supported**.

(ii) **Do not remove any clothing**, unless essential, as clothes act as padding for splints and help to maintain the warmth of the body. **If necessary, rip up the clothes along a seam** to expose the seat of injury.

(iii) **Handle** patient as little as possible and **with gentleness**.

(iv) Generally **guard against shock**.

(v) **Immobilise the injured part by means of bandages and slings**, and only use splints if necessary. Any splint must be well padded. The chest-wall or the sound leg serve as good padded splints for fractures of arm and leg respectively.

(*a*) In the case of an **arm,** pad the limb well, with a broad-fold bandage fix the upper arm to chest-wall, and support the forearm in a sling, the wrist being at a slightly higher level than the elbow (see Fig. 124). This figure also shows variants of this method for treating fractures of the collar-bone and of the lower arm.

(*b*) If a **leg**, pad well between the knees, and bandage the sound leg to the injured. The injured leg must not be moved; kneel alongside it to fix it. Bring the uninjured leg to lie above the injured one in a similar position. Fasten the two ankles, knees, and hips together by narrow-fold bandages

passed under the natural hollows below ankles, knees, and waist, and worked up or down to the desired position. Pad well between the knees and various hollows, using clothing, straw, tow, or whatever is handy. Apply two more bandages around both legs, one above and another below the seat of fracture (Fig. 125). Next, extend the legs by gently pulling the ankle on the uninjured

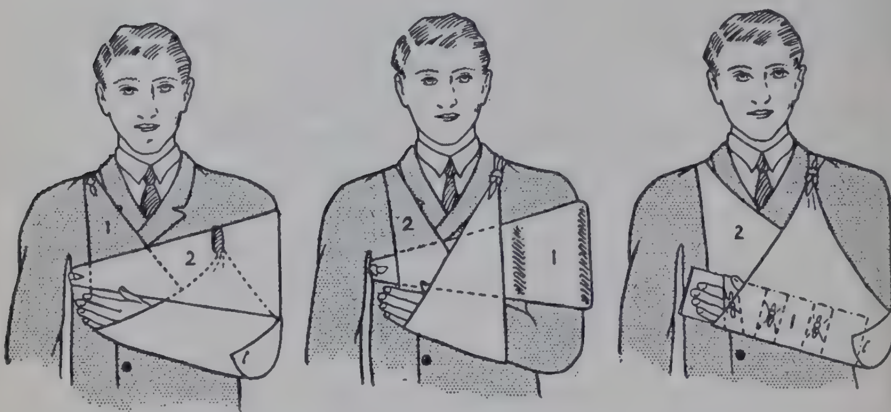


Fig. 124.—First Aid for Fractures of the Arm

side, while another helper tightens each bandage as necessary: most of them will be loose in the straightened position.

(vi) **Never attempt to set the bones.**

(vii) **Do not give food or drink**, as an anaesthetic may need to be given shortly. At most, give a few sips of hot tea or coffee to counteract shock.

2. **First aid for compound fractures**

Treat as for a simple fracture but, in addition —

(i) Expose, and cover the wound with a dry, sterile dressing.

(ii) **Stop any bleeding** by applying a pad and bandage over the wound or, if severe, by compressing the artery at the pressure point with the fingers or tourniquet (Chapter IV).

(iii) Especially take care to **counteract shock** (page 17).

FIG. 125.—USE OF THE BODY AS A SPLINT

A, Supporting the injury B, Bandaged

From Clay: *A New System of First Aid* (Faber)

(iv) **Do not try to push a protruding bone back int place.**

SPLINTS

A splint is a rigid appliance, usually made of wood c metal, which is secured to a fractured limb in order t support it and prevent movement of the broken bone. Th commonest type is that made from a piece of wood cut t the required size, which, after being padded, is fixed alon the length of a broken bone by bandages or webbing-strap with buckles (see pages 79–80). The splint should b sufficiently long to keep not only the broken bone but als the joints above and below it from moving; *e.g.* if a bon in the forearm is fractured, the splint should reach abov the elbow and extend below the wrist. Bandages or strap should be passed round the limb and splint, and fastene firmly but not so tightly as to interfere with the circulation Knots and buckles should be over the splint, not the flesh

Several **types of splints** are used for first aid purposes

1. **Wooden splints** consist of straight pieces of wood c various lengths and widths, which are sometimes made i sections with metal-covered ends which fit into one another in order to suit individual cases.

2. **Gooch's splinting** consists of narrow, flat laths o wood, side by side, fixed lengthwise on sheets of adhesiv plaster. It is usually made into rolls, and can be cut to th required width and length, and moulded to the limb.

3. **Metal splints** are usually made of tin or aluminiur and may be moulded to fit the shape of a limb. They ar generally padded with felt or cotton-wool.

4. **Kramer's splinting** is made of a framework of stou wire which is strengthened by wire struts placed acros and fastened to it. This is a popular form of splint fo first aid use, as it can be cut and bent to fit the natur curvatures of any limb. Plenty of padding is, of course necessary for this.

5. **Improvised splints.** In an emergency when splints are necessary and none of the above is available, they can be improvised from a number of articles, providing that the resulting improvisation is sufficiently firm and rigid to give adequate support to the limb and long enough to prevent movement of the joints immediately above and below the fracture (see page 79).

6. **Body-splinting.** Experience has proved that it is not only difficult to apply the mechanical types of splints, described above, under conditions which obtain in air-raids, but that their application is apt to increase the delay in getting a casualty to hospital, and to increase his shock by the handling which the use of many of these splints necessarily entails. For this reason 'body-splinting' has been devised as a method of immobilising fractures of bones in limbs by utilising parts of the body as a splint. For example, by securing an injured limb to the opposite one in the case of fractures of the lower limb, and to the trunk in the case of fractures of the upper limb (see pages 165–166).

7. **Thomas's splint** may be used under a medical officer's guidance (see Appendix C).

8. **Fixed blanket pads.** Rolled blankets are sometimes necessary on a stretcher to support a casualty's injured parts, and quite often these blanket pads, unless fastened with a triangular bandage or some similar means, will unroll and be valueless for the purpose for which they were intended.

The following method of folding the blanket will provide a firm and soft pad, and if properly made cannot come apart even with rough handling. Only one blanket is needed for this.

(i) Fold the blanket in half with bound edges together.
(ii) Then fold again, lengthwise, making four folds of blanket and lay on flat surface with bound edges uppermost.
(iii) At one end, turn over a flap of about 8 inches to form a pocket.
(iv) Next, roll the blanket from the opposite end, tightly or loosely as desired, and insert the roll into the pocket.

CHAPTER XVI

SPECIAL FRACTURES

In addition to the general signs, symptoms, and first aid treatment of fractures described in Chapter XV, it is necessary to consider special points concerning each of the commoner fractures.

FRACTURE OF THE SKULL

This may occur either on the top or sides of the head (vault) or in the base of the skull (Fig. 110).

1. **Fracture of the vault of the skull**

This is generally due to direct violence, for example, a blow or a fall upon the head, and may be **open or closed.** The skull may be cracked or splintered, and the bone at the site of the break driven inwards, forming what is known as a **depressed fracture.** Bleeding from the fracture or a piece or pieces of broken bone driven inwards may press upon the brain. In such a case, a condition known as **compression of the brain** results. In every fracture of the skull there is bound to be some bleeding within its cavity, but in many instances this does not actually press upon the brain. In most cases there is a condition which is known as **concussion** of the brain (a shaking-up or stunning), and this varies according to the severity of the injury from a headache and dazed state which passes off, to complete unconsciousness.

2. **Fracture of the base of the skull**

This is generally the result of indirect violence, and may, for example, be caused by a blow upon the jaw or when a

person falls from a height and lands upon his feet or buttocks. In this case the shelf within the skull upon which the brain rests is cracked or broken, and, as in a fracture of the vault, bleeding from it may produce compression of the brain.

It will be seen from the above that the main dangers of a fractured skull are its effects upon the brain and nervous system. Of these effects concussion or stunning is by itself the least severe, and may pass off without any serious consequences. If, however, the damage has led to bleeding and pressure on the brain, a casualty will become rapidly or gradually worse and his life will be in great danger. It is, therefore, of the utmost importance for a first-aider to be able to know what to look for so that he can find out whether the skull is broken, and if so, whether it is causing pressure on the brain. In any case, he must regard every fracture of the skull as a serious condition and bear in mind that even if the signs of compression of the brain are not evident at first, they may come on later. In consequence, the casualty must be seen by a doctor and removed to hospital as soon as possible.

(i) The **symptoms, signs**, and treatment of **concussion** and **compression** of the brain and of fracture of the base of the skull are dealt with under Conditions of Unconsciousness, Chapter XIX, pages 226–228.

(ii) **First aid treatment of fractured skull:**

(*a*) **Lay the patient down** with his head on a pillow or a rolled-up blanket.

(*b*) Apply a clean **dry dressing over any wound** on the head and bandage lightly, unless there is much bleeding, then bandage firmly. If a depressed fracture is found or suspected, a **ring-pad** (Fig. 60) should be placed over the site of the fracture so as not to press upon it, and bandaged lightly. If blood or a watery fluid is coming from the ear, nose, or mouth, a light dressing should be placed over the ear simply to prevent disease germs from getting into it. No attempt should be made to

plug up the orifice of the ear or nose to prevent blood from escaping.

(*c*) The patient's **head should then be turned towards the side from which blood is coming**.

(*d*) **Treat shock** by the use of blankets and by hot-water bottles (well protected) placed at the sides and feet of the patient.

(*e*) **Do not give the patient anything to drink,** even if he regains consciousness, for fear of causing him to vomit.

(*f*) Get a **doctor** to see the patient if possible without delay.

(*g*) Send the patient to **hospital** in an ambulance at the earliest opportunity. If he is unconscious, the ambulance attendant must be instructed to keep the patient's head turned to one side and press the lower jaw forward to prevent the tongue from falling back and obstructing the breathing.

FRACTURE OF THE LOWER JAW (MANDIBLE)

1. **Cause:** Direct blows.

2. **Signs**

(i) Pain on movement of jaw.
(ii) Irregularity of teeth, and possibly some loose teeth.
(iii) Bleeding from the gums.
(iv) Dribbling from the mouth.
(v) Difficulty in speaking and swallowing.

3. **Danger:** The fracture is compound into the mouth, as the gum is almost invariably torn, so that sepsis is liable to occur.

4. **Treatment**

(i) Gently **close the mouth** by pressing the lower jaw against the upper.

(ii) **Fix the lower jaw against the upper** by means of bandages, handkerchiefs, or pieces of linen. This can

be done in a number of ways, but the jaw must not be pulled backwards.

The best form of bandage, which is simple and easy to apply, is that known as '**the barrel bandage**'. This method should always be used when there is a danger of the tongue slipping backwards into the throat, as referred to above. To apply this bandage (see Figs. 92, 93, and 94):

(*a*) Without relaxing support of the jaw, place the centre of a narrow-fold triangular bandage under the jaw, and well back, over the dressing. Carry the ends of the bandage upwards in front of the ears, and loosely tie the first loop of a reef-knot on the top of the head.

(*b*) While an assistant supports the jaw, hold the loose ends in your hands and with your fingers open out the knot on the top of the head so as to form two loops, one passing forwards and the other backwards.

(*c*) Guide the forward loop on to the forehead until it lies just above the eyebrows; carry the backward loop on to the back of the head just above the nape of the neck.

(*d*) Gather up the free ends of the bandage and adjust them so that each cross-over is just in front of the ear; then tie them on the top of the head. As an alternative to a triangular bandage, a roller bandage of suitable length may be used.

(*e*) Treat for **shock.**

5. **Transport**

(i) If the patient is fit to travel as a **sitting case**, he should be instructed to sit with his **head held forwards and downwards** to prevent his tongue from falling backwards into the throat.

(ii) If the patient is a **stretcher case**, he should be placed face downwards with his **head hanging over the end of the stretcher canvas**, to prevent the tongue from

falling backwards and to allow free drainage of blood and saliva from the mouth. To do this:

(*a*) Place a **folded blanket** at the head end of the stretcher.

(*b*) Beneath this blanket insert, about a foot apart, **two splints** of sufficient length to reach to the ends of the stretcher poles (each splint should be made of two 12-inch splints joined together).

(*c*) Tie a **narrow-fold triangular bandage** to one pole of the stretcher about 6 inches from its end; pass this first round the end of one splint, then round the other, and tie off round the other pole of the stretcher. This makes a **sling** for the patient's **forehead.** The sling should be made as taut as possible.

(*d*) **An alternative** way of making a firm **sling** for the forehead is to use either a splint long enough to reach between the two stretcher poles, or a newspaper folded up to simulate a splint. Wrap the splint well with cotton-wool, and place its centre just below the apex of a spread-out triangular bandage. Fold the apex over the splint and roll the splint up in it smoothly until the base-line of the bandage is reached. There is a good free length of bandage at each end of the covered splint. Tie the splint in position with these free ends.

(*e*) **Lay patient face downwards** with his chest on the blanket and forehead in the sling. The splints are kept in position by the patient's weight.

Loading into ambulance. It is advisable to load a casualty of this nature feet first into an ambulance to prevent any portion of his face from striking against the cross-bars of the stretcher fitment while the stretcher is being pushed home along the tracks. A lower berth should be selected so that blood and vomit can be collected into a bowl. The ambulance attendant must be given special instructions regarding this type of casualty and told to **report to the hospital authorities as soon as he reaches there.**

FRACTURE OF THE COLLAR-BONE (CLAVICLE)

1. **Cause:** The collar-bone is usually fractured from indirect violence, such as a fall on the outstretched hand or on the tip of the shoulder.

2. **Danger:** There may be injury to big blood-vessels or nerves passing behind the collar-bone, but this is uncommon.

3. **Signs**
   (i) The arm on the injured side is partially helpless; the patient usually supports it at the elbow by the hand of the sound limb.
   (ii) The fractured ends can generally be felt on passing the fingers along the collar-bone. The shoulder is depressed downwards, forwards, and inwards.
   (iii) The general signs of a fracture are present.

4. **Treatment:** The object of the treatment is to draw the outer fragment upwards and outwards and to keep it in place. This is done by bracing the shoulders back and supporting the elbow. The coat, and as much clothing as necessary, are first removed. One of the following two methods of fixation can be used.
   (i) Method for fracture of one or both clavicles (Fig. 126).
      (*a*) Place a **pad in each armpit**.
      (*b*) Pass a narrow-fold bandage beneath the armpit and round the shoulder to form a **ring round each shoulder**.
      (*c*) Under each ring behind pass a narrow-fold bandage and pull fairly tight, so as to '**brace back**' the shoulders.
      Tie in the middle of the back over a large flat pad of dressing.
      (*d*) If one clavicle is broken, **support the arm in a small arm-sling**, but if both are fractured, cross the hands in front of the chest and pass a bandage round the limbs and chest and tie off in front.

This method is easier to apply and is probably the better treatment.

(ii) Alternative method (Fig. 127).

(*a*) Place a **pad** 2 by 4 inches (about the size of a man's fist) **in the armpit** of the injured side.

(*b*) Bend the **elbow to a right angle** and draw the **shoulder back** gently.

(*c*) Get another helper (or failing that, the patient) **to support the limb**, with the forearm resting across the chest.

FIG. 126.—BANDAGING FOR FRACTURE OF ONE OR BOTH CLAVICLES

FIG. 127.—BANDAGE FOR FRACTURE OF RIGHT CLAVICLE

(*d*) Place a pad, such as a **folded towel**, between the forearm and the chest.

(*e*) **Lay an unfolded triangular bandage across the chest** (but place it between the chest and the forearm) with the end on the uninjured shoulder. Take the end that is hanging down and pass it over the forearm and then between the arm and the chest on the injured side, just below the pad in the armpit. Carry this end round across the back and tie to the end lying in front of the sound shoulder.

The apex of the bandage is folded over the

elbow and pinned in front and a bandage placed round the chest and elbow.

Fracture at the shoulder-joint may be at the **outer end of the clavicle**, due to a fall on the point of the shoulder, near the **glenoid fossa** of the scapula, or at the **upper end** of the **humerus**.

1. **Cause:** Fall on the shoulder or outstretched hand.

2. **Signs:** The general signs of fracture are likely to be present.

It is difficult to tell if there is a fracture or dislocation.

In fracture, the elbow is likely to be held close to the body, and the patient will suffer pain if the arm is lifted from the body. If in doubt as to whether there is fracture or dislocation, treat as for fracture.

3. **Treatment** of a fracture at the shoulder-joint:
 (i) **Apply a broad-fold bandage** with its centre laid upon the outer and upper part of the arm and shoulder, and carry the ends round the body, one in front and one behind, so that they meet below the armpit on the sound side. They can be tied over a pad here — or, better still, if sufficiently long, crossed and tied in front of the shoulder of the normal side.
 (ii) **Support the forearm by a small arm-sling** (Fig. 128).

FRACTURED SHOULDER-BLADE (SCAPULA)

1. **Cause:** This rare fracture occurs from crushes, such as between a lorry and a wall, or from a blow from a railway buffer or motor van.

2. **Signs** are difficult to make out, but if there has been a severe blow over the scapula, and there is pain on moving the arm, tenderness over the scapula, and perhaps a feeling of crepitus, treatment for a fracture should be carried out.

3. **Treatment**
 (i) **Remove coat** and waistcoat and braces from a man, or a heavy coat in the case of a woman.

(ii) Place a **pad**, such as the folded waistcoat, **over the injured bone** and a soft pad **in each armpit**.

(iii) Apply the middle of a **broad-fold bandage beneath the armpit** of the injured side (Fig. 129). Carry one end over the front of the chest and the other over the

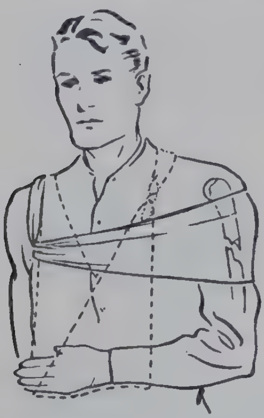


FIG. 128. — BANDAGE FOR FRACTURE AT SHOULDER-JOINT OR OF UPPER END OF HUMERUS

FIG. 129. — BANDAGE FOR FRACTURED LEFT SCAPULA

pad on the injured scapula to the opposite shoulder. Pull somewhat tightly and cross the ends. Then bring the ends to the axilla on the uninjured side and tie them over the pad there.

(iv) Place the arm on the injured side in a **large arm-sling**.

FRACTURED UPPER ARM (HUMERUS)

1. **Cause:** The humerus may be broken near the shoulder-joint, in any part of the shaft, or near the elbow. The cause is either direct violence or indirect, such as a fall on the hand or elbow.

2. **Danger**

(i) Injury to the main blood-vessel of the arm.

(ii) Injury to one or more nerves, causing partial paralysis of the hand, such as inability to raise the wrist (wrist-drop).

3. **Signs :** All the general signs of fracture are likely to be present : pain, swelling, deformity, or abnormal movements.

If the fracture at the lower end extends into the elbow-joint, the swelling is considerable ; movement at the elbow is restricted and painful. This injury is common in children.

4. **Treatment**

(i) **FRACTURE OF THE SHAFT OF THE HUMERUS** (Fig. 130) :

(*a*) Bend the **forearm at a right angle** to the arm and get another helper (or the patient) to support it in this position.

(*b*) Put on a **small arm-sling** supporting the wrist and hand.

(*c*) Take **three small splints** (pieces of wood or cardboard, book covers, folded newspapers, or such-like) long enough to reach from the shoulder to the elbow, and **pad them.**

FIG. 130.—FIRST AID FOR FRACTURE OF SHAFT OF HUMERUS

(*d*) Put a **pad in the arm-pit**—pocket handkerchief, wool, or a scarf, so as to protect the vessels and nerves from pressure by the splints.

(*e*) Apply **these splints**, one on the inside of the arm, the other on the outside, and the third on the back of the arm. No splint should press into the axilla or into the bent forearm.

(*f*) Apply **two narrow-fold bandages** round the splints and the arm, one above the fracture and the other below it, tying the knots on the outer side.

(*g*) **Feel the pulse** at the wrist. If it cannot be felt, immediately loosen the bandages round the arm until the pulse is felt.

If two splints only can be improvised, place one on the front and the second behind the arm.

If no splint of any kind is available, fix the arm to the side of the body by two broad-fold bandages.

(ii) **FRACTURE OF THE LOWER END OF THE HUMERUS** (near the elbow-joint):

(*a*) Take two flat pieces of wood, one long enough to reach from the armpit to below the elbow and the other long enough to reach from beyond the elbow to the tips of the fingers. **Cross the splints** near one end and fix them at a right angle with a bandage, string, tape, or adhesive plaster (Fig. 131). Pad the splint.

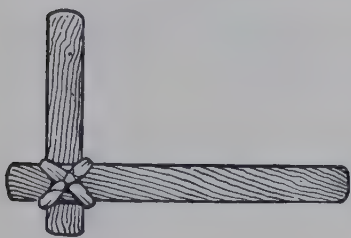


FIG. 131.—SPLINT FOR ELBOW

(*b*) Bend the **forearm at a right angle** to the arm and make the patient hold it in this position, while splints are applied.

(*c*) Put a soft **pad in the armpit**.

(*d*) **Apply the padded side of the splint** on the side of the limb that shows least swelling or sign of injury.

(*e*) **Secure** by one narrow-fold bandage round the arm, one round the upper part of the forearm, and one round the wrist and hand (*i.e.* using three bandages).

(*f*) Support the arm in a **large arm-sling**.

(*g*) **If no splint is available**, take two whole newspapers; fold them lengthways, so as to make two pads each about 6 inches wide and 24 inches long; place one behind the arm and below the forearm, and the other down the front of the arm, elbow, and along the forearm. Secure them with a band-

age, towel, or any material available and place in an improvised large sling.

(*h*) If the patient can be **taken to a house and medical aid cannot be obtained quickly**, put the patient to bed, remove the splints, and lay the arm on a pillow. A cold-water dressing should be applied over the painful area until the doctor arrives.

FRACTURED FOREARM

Both radius and ulna may be fractured, or either bone may alone be broken.

(i) **Cause:** These fractures are due to direct or indirect violence, such as blows, or falls on the hand or forearm. 'Back-fires' from starting motors often cause fractures near the wrist.

(ii) **Danger:** Although the fracture may be compound, immediate complications are unusual.

1. **FRACTURE OF OLECRANON** (tip of the elbow):

The olecranon is the prominence at the back of the elbow and is the upper end of the ulna.

(i) **Signs**

(*a*) Swelling, discoloration, and pain at the back of the elbow.

(*b*) A gap may be felt below the tip of the elbow, owing to a part of the olecranon being pulled upwards, half an inch or so.

(*c*) The elbow cannot be straightened out.

(ii) **Treatment**

(*a*) Take a **straight bit of wood**, cardboard, or folded newspaper, long enough to reach from the middle of the arm to the wrist. Place this along the front of the arm and forearm.

(*b*) **Secure with two narrow-fold bandages**, and fix with a bandage to the body (Fig. 132).

2. FRACTURE OF THE SHAFTS OF BOTH RADIUS AND ULNA

(i) **Signs**

(*a*) All the signs of fracture are usually present.
(*b*) There may or may not be deformity.

Fracture of the radius alone is more common than fracture of the shaft of the ulna alone. In each case the usual signs of fracture are present.

(ii) **Treatment**

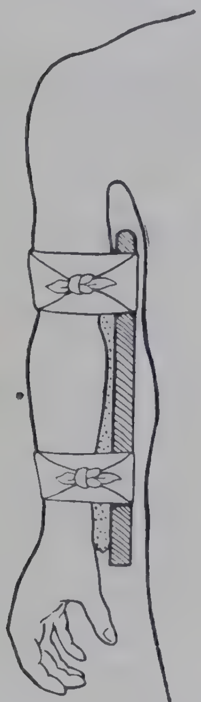


FIG. 132.—SPLINTING AND BANDAGING FOR FRACTURED OLECRANON

(*a*) Pad two wooden **splints** well, or use cardboard or folded newspaper. One splint should extend from beyond the back of the elbow to the knuckles, and the other from the front of the elbow to beyond the finger-tips.

(*b*) Bend the **elbow to a right angle**, and place the forearm in position midway between pronation and supination. This is done by placing the hand with the thumb upwards and the palm looking towards the body.

(*c*) Apply the shorter **splint** along the palm of the hand and up the forearm, and the longer one on the back of the forearm, placing its lower end no farther than the knuckles.

(*d*) **Secure with three narrow-fold bandages**, one above and one below the fracture, and one round the hand below the thumb (Fig. 133).

(*e*) **Examine the finger-nails** and see that the colour returns to them after slight pressure with the fingers. If not, loosen bandages.

(*f*) **Support** splints and forearm **in a large arm-sling.**

3. FRACTURE AT THE WRIST (Colles's Fracture)

This common fracture at the lower end of the radius with slight injury to the end of the ulna is caused by falls on the outstretched hand. 'Back-fires' from cars often cause this fracture. In some cases the fracture is impacted, so the signs and symptoms suggest a sprained wrist and not a fracture.

(i) **Signs**

(*a*) Swelling and pain, often extending up the forearm; bruising is not evident for a day or two.

In severe fractures there is also —

(*b*) A prominence on the back of the wrist.

(*c*) Deformity at the wrist, consisting in the hand being tilted to the thumb side (Fig. 134).

FIG. 133.—SPLINTING AND BANDAGING FOR FRACTURED RADIUS AND ULNA

FIG. 134.—THE DEFORMITY IN COLLES'S FRACTURE

(ii) **Treatment.** Treat this as a fracture of the shaft of the bone. If, however, it is known that the patient can be **taken quickly to a doctor or a hospital**, do not apply splints; soak a handkerchief or cotton-wool in cold water and lay it round the wrist. Put the arm in a large arm-sling.

FRACTURES OF THE HAND

1. **Cause :** Machinery accidents often cause severe laceration of the hand with fracture of several metacarpal bones and phalanges, so that the fractures are compound. The third and fourth metacarpal bones are not infrequently broken by direct violence, and the base (the upper part) of the metacarpal bone of the thumb is sometimes broken by boxers.

2. **Signs :** The usual signs of fracture are present.

3. **Treatment :** Place the palm of the hand upon a piece of wood, cardboard, or folded newspaper, about 8 inches long and 3 or 4 inches wide. Secure by a **narrow-fold bandage carried figure-of-eight** fashion round the hand and wrist (Fig. 135). Place the hand in a **sling** or inside the coat. If the attendant is certain that only one small bone of a finger is broken, a small padded splint can be secured by tape or adhesive plaster to the front or palmar surface (opposite side to the finger-nail) of the finger.

Fig. 135.—Bandage for Fractured Bones of Hand

FRACTURED RIBS

1. **Cause :** One or more ribs may be broken by
 (i) direct violence from a blow or a fall upon the chest, or impact against the driving-wheel of a car ;
 (ii) indirect violence, as when the chest is crushed, say between a motor-bus and a wall.

2. **Signs :** The 6th, 7th, 8th, and 9th ribs are those most often broken.
 (i) There is severe pain on deep breathing or coughing, near the fractures ; the breathing is shallow.
 (ii) An irregularity may be felt if the finger is passed along the rib, and pressure at the place of irregularity will cause pain and 'catching of the breath'.

3. **Dangers**

(i) Injury to the lung occurs if the broken end of the rib is driven inwards. This is indicated by the coughing up of a frothy and bright-red blood — a serious condition.

(ii) Injury to the liver or spleen may complicate the fracture of the lower ribs and cause internal haemorrhage.

(iii) An open wound may exist over the site of the fractured ribs, allowing direct entrance of air which is sucked into and blown out of the lung with a whistling sound as the patient breathes in and out. Breathing becomes increasingly difficult as the lung tends to collapse, and the life of the patient is in danger.

Reference to Fig. 163 will be helpful in enabling the reader to see how a broken rib may injure various internal organs.

4. **Treatment**

(i) **When there are no signs to suggest injury to an internal organ:**

(*a*) Apply **two broad-fold bandages round the chest,** the centre of each being over the part which is painful. Make the lower bandage overlap the other, and tie each on the sound side of the chest, at the **end of expiration**. These bandages should be sufficiently tight to relieve the pain on breathing, but should allow some expansion on the injured side of the chest (Fig. 136).

FIG. 136.—BANDAGING FOR FRACTURED RIBS

(*b*) Place the **arm on the injured side in** a large sling.

A towel folded about 10 inches wide and carried

round the chest and fixed with safety-pins gives good support instead of the bandages.

(ii) **When an internal organ is injured** (see page 54):

(*a*) Send for a **doctor.**

(*b*) **Do not apply bandages** round the chest, for they would increase the injury.

(*c*) **Lay** the patient down and incline him **towards the injured side**.

(*d*) **Loosen clothing**, give **ice to suck**, and place an ice-bag over the site of the injury. If ice is not available, allow the patient to wash his mouth out with cold water and place a cold compress over the injury.

FRACTURED PELVIS

1. **Cause:** Fracture of the pelvis is due to a severe injury, such as run-over or crush accidents. One side of the pelvis alone may be broken; often there is a fracture both in front and at the back of the pelvic bones.

2. **Danger:** Injury to the bladder, the urethra, or, occasionally, the bowel.

3. **Signs**

(i) A large bruise.

(ii) Inability to stand without pain.

(iii) Inability to move legs freely.

(iv) Pain on pressing the sides of the pelvis together.

(v) Blood may be passed in the urine.

4. **Treatment**

(i) Place the patient in whatever position he finds most comfortable. Preferably this should be **flat on the back**, with the thighs and legs straight.

(ii) Pass a **broad-fold bandage** (towel or such-like) beneath the hollow of the back and work it down round the pelvis. Stretch it and carry it round the front of the body, fixing it as tight as is compatible with comfort.

(iii) **Tie the legs together.**
(iv) **Remove** him in a manner similar to that adopted for fracture of the spine (pages 197–201).

FRACTURE OF THIGH-BONE (FEMUR)

The femur may be fractured:
(i) at the neck;
(ii) through the shaft;
(iii) near the lower end.

1. **Cause:** The shaft and the lower end of the femur are usually fractured by great violence, such as a fall from a height or a run-over accident. The neck of the femur is also often broken by slight indirect violence such as tripping up; this often occurs in elderly people.

2. **Danger:** Compound fracture and fracture into knee-joint; injury to femoral artery; shock.

3. **Signs:** The general signs are described on page 163. The foot lies on its outer side. The patient cannot lift the injured leg off the ground. Bruising is usually extensive. Shortening may vary from half an inch to 3 inches.

4. **Treatment:** The first aid treatment depends on the apparatus available.

An ambulance should be sent for promptly, and the nearest hospital notified. A doctor should be communicated with. The most efficient splint is the **Thomas's splint**. The way to use this is described at Appendix C.

If it is known that an ambulance is bringing a Thomas's splint, keep the patient warm meanwhile.

(i) **If no splint at all is available**, the two legs should be bound together by handkerchiefs, belts, etc. — one placed round the top of the thighs, another above the knees, a third below the knees, and a fourth holding the ankles and feet together (see Fig. 125).

(ii) **Fixation by splints.** Join four or five 12-inch interlocking splints together or a piece of wood about ½ inch thick and 4 inches wide that will reach from the arm-

pit to beyond the heel, or use broom-handles, walking-sticks, billiard cues, or rolled-up maps.

(*a*) **Lay the patient flat on his back.** If there is great deformity at the site of fracture, or if the limb is 2 inches or more shorter than the corresponding limb, steady the limb and gently draw it down, by grasping the ankle till alignment with the sound leg is obtained. This should be done gently, or omitted if it causes severe pain.

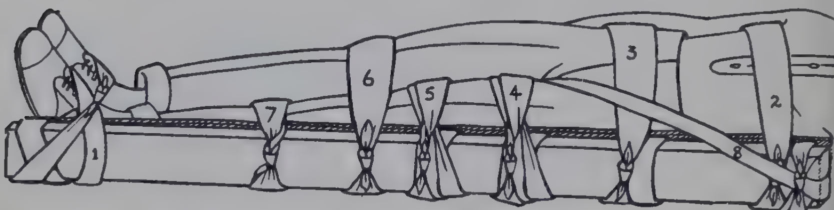


FIG. 137.—SPLINT FOR FRACTURED LEFT THIGH WITH CRUTCH BAND

The splint has been applied over clothing and shoes. The numbers on the bandages indicate the order in which they are applied

(*b*) **Pad the splint** with cotton-wool, paper, grass, etc., and lay it along the outer side of the body and limb on the injured side. A second splint placed on the inner side of the leg extending from the groin to the foot will strengthen the fixation; failing this, the other leg can be tied to the injured one, after it has been splinted.

(*c*) **Eight bandages** are required for efficient **fixation** (Fig. 137). The first holds the foot to the splint; it is passed beneath the hollow above the heel (between the heel and the calf) round the ankle and the splint; the ends are crossed in front of the ankle and passed round the foot, so as to cross in the middle of the sole of the foot. The end passing outwards is then passed up the outer side of the splint and passed twice round the splint. Next it is carried up over the foot of the affected side, the other end is passed round the foot of the unaffected leg (*i.e.* below the sole and round the

outer border of this foot), so as to meet the other end of the bandage on the upper surface of the two feet. The ends are knotted in the space between the two feet. If the bandage is sufficiently long, another turn round both ankles and splint can be made.

The second holds the chest to the splint; it is passed beneath the hollow of the back and slipped upwards, so as to lie just below the armpit. One turn is taken around the splint, and the bandage is pulled firmly and tied over the splint.

The third holds the pelvis to the splint; it is passed beneath the hollow of the back and slipped downwards to the level of the broadest part of the pelvis; a turn is taken round the splint and it is tied tightly on the outer side of the splint.

The fourth holds the thigh above the fracture to the splint. It is folded lengthways, and the folded end is passed from the outer side beneath the hollow below the hip and brought over the front of the thigh until it reaches the splint. One of the loose ends is taken round the splint and passed through the loop formed at the folded end. The other end is passed through the loop in the opposite direction, and the two ends are tied up over the splint.

The fifth secures the thigh below the fracture to the splint. It is passed beneath the knee, slipped upwards and tied above the knee in a similar manner to the fourth bandage.

The sixth holds both knees and splint together.

The seventh secures the leg to the splint; it can be passed round the injured leg and the splint, or round both legs and the splint and tied on the outer side.

The eighth acts as a retaining band. It is passed round the crutch and fixed to the top of the splint.

(*d*) **The injured limb must not be lifted while i is being splinted.**

(*e*) The **bandages should be passed under th natural** hollows — waist, knee, ankle — to avoi raising the patient. Fold the bandage to be passe **over the ends of your fingers**, so that you ca feel what you are doing: a piece of stick is not s suitable for this purpose as it may hurt the patien

(*f*) No **bandage** should encircle the limb exactly **ove the fracture**.

(*g*) The **knots** should lie on the **outer side of th splint**, except over the foot.

(*h*) If the patient is a woman, the skirts must be turne upwards before bandages are applied round th thighs.

FRACTURE OF KNEE-CAP (PATELLA)

1. Cause

(i) Muscular violence: This may occur in an attempt to prevent a fall, when the foot slips. The sudden contraction of the thigh muscles when the knee is partly bent causes the patella to snap transversely in two across the lower end of the femur (Fig. 138).

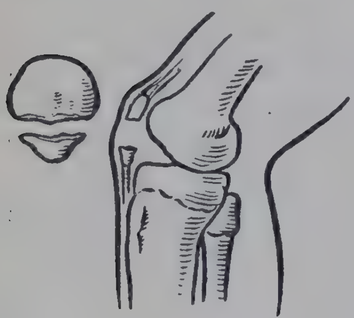


Fig. 138.—Patella in two portions due to a Transverse Fracture; and side view of a Knee-Joint showing gap between the two fragments

(ii) Direct violence, *e.g.* a fall on the knee, produces a comminuted fracture.

2. Signs

(i) Pain.

(ii) Inability to straighten the leg.

(iii) A gap may be felt between the broken fragments.

(iv) Swelling of the knee and bruising.

3. **Treatment**

(i) **Lay** the patient down **on his back**, and **support the head and shoulders** with an inverted chair, pillows, or coats.

(ii) **Straighten the leg, and raise it** to half a right angle with the ground. It should be held in this

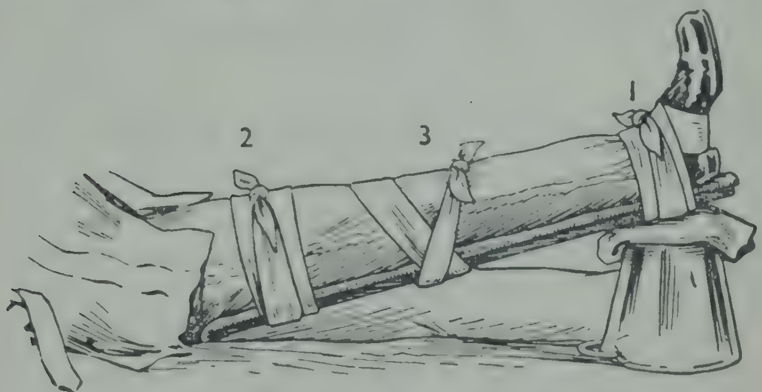


FIG. 139.—TREATMENT OF FRACTURED PATELLA

position by another helper or **supported** as shown in Fig. 139.

(iii) Apply a **splint** along the **back of the limb** from the hollow below the hip to beyond the foot.

(iv) **Three bandages** are required (Fig. 139):

(*a*) Place the middle of a narrow-fold bandage across the sole of the foot (or shoe) in front of the heel. Cross it in front of the instep, carry it round the ankle and the splint, and tie in front of the ankle. If it is a long bandage, cross it again and tie off under the sole.

(*b*) Place a broad-fold bandage round the middle of the thigh, securing the splint to the thigh, to attempt to bring the broken fragments together, by pulling the upper fragment down to the lower one.

(*c*) Take a narrow-fold bandage and place its centre across the lower end of the front of the thigh,

just above the patella. Carry the ends round the back of the splint and knee, crossing them at the level of the knee-joint. Bring them round to the front of the limb just below the patella, pull them tight and tie.

(v) The **lower end** of the **splint** is then **rested on folded coats**, a box, a pail, or some such article (Fig. 139).

(vi) **Apply ice** or **cold-water dressings** over the knee.

FRACTURE OF THE LOWER LEG

1. **Cause:** One or both bones of the leg may be broken by direct or by indirect violence. Run-over accidents often break both tibia and fibula. Twisting of the foot may cause fracture of the fibula alone.

2. **Danger:** As the tibia lies just under the skin, a fracture of this bone is often compound. Furthermore, a simple fracture may become compound if the leg is moved carelessly.

3. **Signs**

(i) Fracture of both bones of the leg gives all the general signs of a fracture.

(ii) When only one bone is fractured, there is no shortening, as the length of the leg is maintained by the sound bone.

(iii) When the fibula is broken 2 inches or so above the ankle-joint and the internal malleolus of the tibia is, or is not, torn off, the condition is called **Pott's fracture** (Fig. 140). This common accident, caused by the foot 'turning under' when the patient slips, causes swelling and discoloration around the ankle; the foot looks twisted outwards and the heel is unduly prominent behind. Weight cannot be borne on the foot (Fig. 141).

(iv) If in doubt as to whether there is a fracture near the ankle, or a sprained or dislocated ankle, treat the case as a fracture.

4. Treatment

(i) **Steady the limb** by holding the ankle and foot.

(ii) **Do not remove the boot**; it often acts as a splint.

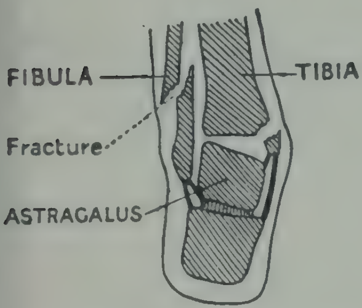


FIG. 140.—POTT'S FRACTURE

FIG. 141.—DEFORMITY OF THE FOOT AFTER A POTT'S FRACTURE, VIEWED FROM FRONT AND SIDE

(iii) If no splints are available, **tie the knees, legs, and feet** firmly together, or if a cushion is available place this behind the leg and bandage it firmly round the leg.

(iv) Apply **splints** to the outer and inner sides of the leg, reaching from above the knee to beyond the foot. Should only one splint be available, this should be placed on the outer side of the leg.

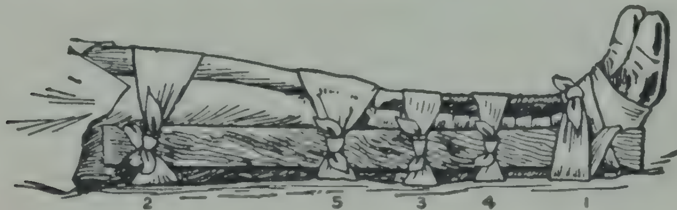


FIG. 142.—FRACTURED LEG-BONES PUT UP BY ONE HELPER

(v) **Five bandages** are required. With the first secure the splint to the foot. With the second fasten the top of the splint to the thigh above the knee-joint. With the third encircle the leg and splint above the fracture,

and with the fourth below the fracture. Tie the fifth bandage round both knees and the splint (Fig. 142).

(vi) **Do not place a bandage directly over the fracture.**

(vii) **Never apply a splint to the front of the leg.**

COMPOUND FRACTURE OF THE LOWER LEG

This is a common injury in road or rail accidents.

1. **Symptoms**

(i) Pain in the leg.

(ii) Inability to move the foot.

2. **Signs**

(i) The foot rolls outwards.

(ii) Blood on the stockings or trousers.

(iii) Deformity in the middle of the leg.

(iv) A wound is seen on the front of the leg, and a piece of bone may protrude from it.

3. **Treatment**

(i) Whenever possible, send for an **ambulance** and **doctor**.

(ii) **Rip** up the seam of trousers to **expose the wound**.

(iii) Apply a **first aid dressing** if available, otherwise place a **clean handkerchief** or piece of linen or paper on the wound.

(iv) **Steady the limb**, pulling the foot out straight. Make no attempt to push in protruding bone.

(v) **Splint the limb and tie the legs together**, as indicated in Figs. 142, 143, or 144, depending on materials available.

(vi) Get the patient to a **hospital** as **quickly** as possible.

FRACTURES OF THE FOOT

Crush injuries of the foot are caused by a vehicle passing over the foot, by a weight falling on it, or by a fall from a height.

1. **Signs:** Pain, swelling, and loss of power.
2. **Treatment:** If in doubt as to whether the soft tissues only are crushed, treat after this manner:

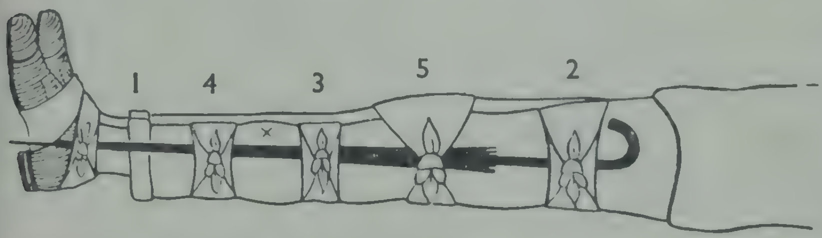


FIG. 143.—FRACTURE OF SHIN-BONE, USING UMBRELLA AS SPLINT

(i) **Carefully remove the shoe or boot**; if need be, cutting the leather over the instep.
(ii) Put some **padding on a flat piece of wood**, large

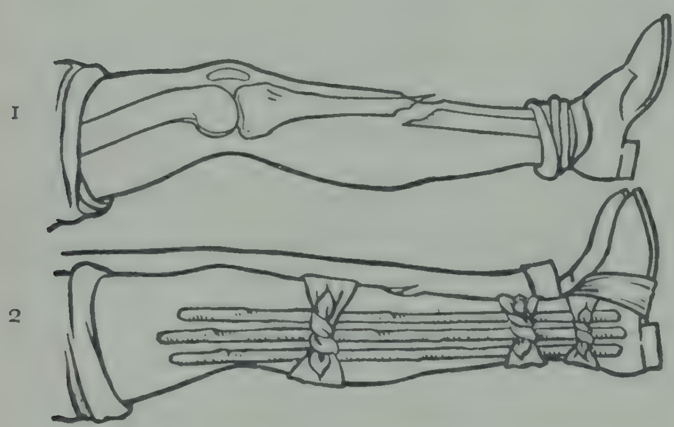


FIG. 144.—COMPOUND FRACTURE OF TIBIA

(1) Shows bone protruding through skin. (2) Shows first aid treatment of a simple kind. Method shown in Fig. 142 should be employed if material is at hand. If the protruding bone remains outside the skin when the foot is steadied, no attempt should be made to replace it. Sticks from a hedge may be fixed with handkerchiefs. Further handkerchiefs should be used to tie the two legs together

enough to reach from the heel to the toes. A towel, a shirt, or wool can be used to pad it.

(iii) Place the **splint on the sole** of the foot. Keep th foot at right angles to the leg.

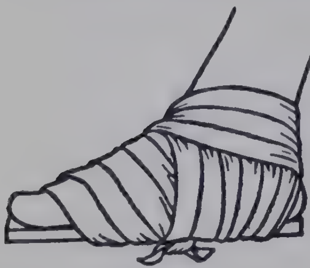


FIG. 145.—SPLINT APPLIED TO FOOT

(iv) Place the centre of the **band age over the middle o the splint** and carry th ends round to cross over th instep. Next pass the end round the lower part of th leg, just above the heel bring them back over th instep, and tie over the splin on the sole (Fig. 145).

(v) **Support the foot in a raised position.**

FRACTURED SPINE

The common sites of fracture of the spine are the neck and the small of the back. In addition to the fracture of the vertebral column there may be an injury to the spinal cord, which lies inside the spinal canal. Injuries to the spinal cord are serious and result in paralysis of the limbs or trunk and in loss of sensation.

1. **Causes:** Direct or indirect violence may result in a fractured spine. Examples are: run-over accidents, car, train, or aircraft crashes, and a fall from a height on the head or on the feet.

2. **Complications**
 (i) Shock.
 (ii) Paralysis of the legs and lower part of the body, due to injury to the spinal cord.
 (iii) Loss of control of the bowel or bladder.

3. **Signs**

Pain in the back at the site of the fracture. Except for the history of the injury, there may be no other clue to the nature of the damage that has been done.

 (i) In **broken neck** with spinal-cord injury there is:
  (*a*) Paralysis of arms, body, and legs.

(*b*) Loss of feeling, so that the patient cannot feel the skin touched at any area below the shoulders.
(*c*) Difficulty in breathing and swallowing.

(ii) In **broken back** with spinal-cord injury there is:
(*a*) Paralysis of the legs.
(*b*) Loss of feeling up to the level of the navel.
(*c*) Lack of control of bladder and bowels: urine and motion are passed involuntarily.

A severe injury to the head or spine, and fracture of the pelvis or of both legs, are the only injuries which cause sudden paralysis of both legs.

Ask how the injury occurred, as this may give the clue to the nature of the injury.

4. **Treatment**

(i) Try to get a **doctor immediately.**

(ii) **If there is pain in the abdomen**, there is probably abdominal injury in addition to that of the spine. Treatment is then required for the **abdominal condition** in preference to the spinal injury (see pages 55, 56, 239, and 240).

(iii) **If a doctor is not readily available**, proceed as follows:
(*a*) Place pads between the ankles, knees, and thighs, and a figure-of-eight **bandage round the feet and ankles**; tie the knot under the soles of the feet.
(*b*) Place broad **bandages round knees and thighs**.

5. **Removal of a patient with fractured spine from the scene of the incident.** Special attention must be devoted to this point since an error may have grave consequences.

In moving or lifting the patient, his **spine must not be bent**, twisted, or over-extended at the site of the injury. The risk of damage to the spinal cord or nerves is greatest in cases of fracture dislocations, especially in the cervical and lumbar regions (*i.e.* the movable parts of the spine).

In a fracture of the spinal column at any level the patient

must be **transported on his back.** If he is found in some other position he must be very carefully turned over 'in one piece' by two or more bearers, four if possible.

A stretcher should be brought and made ready. If the structure is of wood with canvas bed portion, it should be made **rigid and quite flat by stiffening** it with a series of short transverse boards, or a shutter, door, or plank of suitable length and width can be used. A blanket folded lengthwise should be placed on the stretcher and special care taken that when the patient is laid upon it **neither his clothes nor the blanket are wrinkled**. The metal bed portion of a Civil Defence type stretcher is sufficiently rigid and does not require extra support.

The lifting and placing of the patient upon the stretcher should be done in one of the following ways, according to the material and to the number of helpers available.

The process should be carried out with the greatest care, taking particular trouble to see that the whole length of the patient's back, his head, and legs are kept straight.

Method No. 1

Five bearers are required — especially in cases of fracture dislocation. A blanket is placed lengthwise on the ground in line with the patient and rolled up for half its width. One bearer supports and applies gentle traction to the feet and legs if the lumbar region is fractured, or to the head if the neck is broken, while the patient is very carefully turned on his side by the other bearers, every precaution being taken that no movement occurs at the site of the fracture. The rolled portion of blanket is then placed close to the patient, and over it he is gently replaced on to his back upon the unrolled portion of the blanket; the rolled portion is next unrolled so that he lies in the centre of the opened blanket. The two edges of the blanket are then rolled up against the patient's body and grasped by two bearers on each side. With the first bearer maintaining gentle traction on the feet and legs or on the head,

as the case may be, all four bearers acting together lift the patient carefully and evenly, while a sixth bearer, if available, slides under him the stretcher upon which he is to be laid. If there is no one to slide the stretcher under the patient, the five bearers should move with short, smooth, side paces until the patient is over the stretcher; he is then slowly lowered on to it.

If only three bearers are available, one should go to each side of the patient and grasp the edge of the blanket with his hands wide apart and opposite to the patient's shoulders and hips, while the third bearer supports and applies gentle traction to the feet and legs or to the head. All three bearers acting together lift the patient and carefully lower him on to the stretcher.

Method No. 2

If a blanket is not available, open out the patient's coat and roll it firmly, so that the roll is close up against his sides. Two bearers on each side grasp the rolled-up coat and the clothing round his thighs while a fifth bearer, if available, supports the head and neck.

Method No. 3

Where methods (1) and (2) cannot be used at an incident owing to the presence of debris or an uneven surface beneath the patient, or if his clothing is damaged or destroyed, the following method may be adopted, but five fully trained bearers are necessary for this.

The patient can be lifted by means of webbing-bands, as carried by Civil Defence rescue parties. One band is worked into position beneath the patient's shoulders, a second beneath the small of his back, a third beneath the upper part of his thighs, and a fourth beneath his calves. Two bearers stand on each side facing towards the patient and each grasps two handles, the bearer at the head end holding the handles of the bands passing beneath the shoulders and the upper part of the thighs, while the bearer at the foot end holds the handles of the bands passing beneath the hips and the calves, the two middle

handles crossing one another. The fifth bearer suppor and maintains gentle traction on the head when the fractu is in the neck. Where it is certain or suspected that th fracture is in the lumbar region, a sixth fully-trained beare is necessary to apply gentle traction to the feet and leg while a fifth bearer supports but does **not** maintain tractio on the head.

Whether the injury is in the cervical or the lumba region, pillows or pads sufficiently large, but not too large to preserve the normal curves of the spine should be place upon the stretcher **under** the shoulders and the small o the back of the patient, before he is laid upon it (see Fig 146). With cervical injuries the head should be steadied by a sandbag placed on each side.

If it can be spared, a folded blanket should support th calves and thus relieve pressure on the heels.

If the patient has to be carried over rough ground, it i often advantageous to minimise movement of his body on the stretcher by binding him firmly, but not tightly, to the stretcher with broad-fold triangular bandages.

All cases of fractured spine at an incident should be labelled with the symbol X and sent in an ambulance to a hospital as soon as possible. The ambulance attendant must be informed of the nature of the injury, and directed to pass on this information to the hospital authorities on arrival.

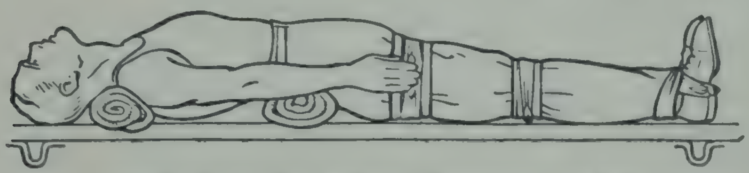
6. **Special blanket stretcher pads for spinal injuries.** When a casualty suffering from spinal injury has to be transported, it is often difficult to determine how large or smal to make the pillows or pads used to preserve the norma curves of the spine. The following method has been devised which with slight adjustment is applicable to any casualty. Only a standard issue blanket is required. The preparation is as follows:

(i) Fold blanket, lengthwise, into four and lay it on a flat surface.

(ii) Turn over about 3 inches at each end and continue

folding one end four more turns. This completes the smaller pad for the casualty's neck.

(iii) Continue folding the opposite end until this pad is approximately 12 inches from the other. The distance



Patient in supine position with 'bolster' support to raise small of back, and to allow head to fall back

FIG. 146.—TREATMENT OF FRACTURED SPINE

Patient should be placed face upwards with padded supports for hollow of neck and small of back. In addition, the arms should be fixed by a broad-fold bandage carried round the body and arms just above the elbows

can be measured by means of a small arm-splint which is a foot in length. This completes the larger pad for support of the lumbar region.

(iv) The completed pad should be placed on the prepared stretcher and adjusted, where necessary, as the casualty is being lowered thereon.

CHAPTER XVII

MUSCLES AND JOINTS AND THEIR INJURIES

(Strains, Sprains, and Dislocations)

MUSCLES AND TENDONS

1. Structure and function of muscles and tendons

(i) **Muscles** are the fleshy part of the body and certai of them help to give it its contour. The movements o the limbs and the contraction of various interna organs, such as the heart and the intestines, ar brought about by means of muscles.

(ii) **Tendons** are the attachments of the muscle to **bone** Their structure is fibrous and tough, not fleshy lik muscle tissue. Most muscles have broad, short tendons, but those which control the movements o the fingers and toes have very long tendons, which are enclosed in special lubricating sheaths and appea as stout glistening cords.

(iii) **Muscles act** by contracting and relaxing. Contrac-tion of a muscle results in a shortening of it, and thi acts on the attached tendinous end fixed to a bone an so produces movements, such as the bending of an elbo or a knee.

(iv) **The nerve supply to muscles** come from the spina cord. Voluntary movements are performed as th result of nerve impulses from the brain passing dow the spinal cord and out along the nerves supplyin the appropriate group of muscles. Should a nerve b injured, cut, or compressed, no messages or impulse can reach the muscle so no movements can take place

the muscle is paralysed. Paralysed muscles lose their elasticity and soon waste.

2. Varieties of muscles

There are two varieties of muscles; voluntary and involuntary.

(i) **Voluntary muscles** produce movements of the limbs, trunk, and head, and are under the control of the will. They consist of bundles of fine fibres which have a stripe in them which can be seen under the microscope; they are called the '**striped**' muscles.

(ii) **Involuntary muscles** are those which control the movements of internal organs, such as the heart, the intestines, and stomach, and which regulate the size of the blood-vessels. They are not under the influence of the will and hence they are called 'involuntary'; they have no tendons as they are not attached to bone. Under the microscope no stripes are seen in their fibres, so they are also spoken of as '**plain**' or '**non-striped**'. The heart muscle, however, is a specialised involuntary muscle and has striations.

3. Groups of muscles

Most muscles of the limbs have a central part known as the **belly**; two attachments, one to the trunk or the upper part of a limb called the **origin**, and the other to a lower part of a limb spoken of as the **insertion** (Fig. 147). The function of limb muscles is specialised: to bend or straighten a joint, to move the limb in a given direction towards or away from the trunk (Fig. 148). These movements are performed by **groups** of muscles. The group which bends a joint is called **flexor**, that which straightens a joint **extensor**. When a limb is moved away from the trunk, the movement is called **abduction**, and the group of muscles responsible for such movement are the **abductors.** Similarly, **adduction** is the movement of a limb towards the trunk, and the muscles which perform such movement are the **adductors**.

STRAINS

Injuries to muscles and tendons are of two types — strains and tears. A **strain** is a mild injury causing the rupture of a few muscle or tendon fibres without any injury to its sheath. It is generally caused by a wrench, a twist, or a sudden effort, such as by lifting heavy weights. It causes a slight swelling, pain and stiffness. A **tear** or **rupture** is a more serious injury, when an entire muscle bundle or tendon is torn across. In such

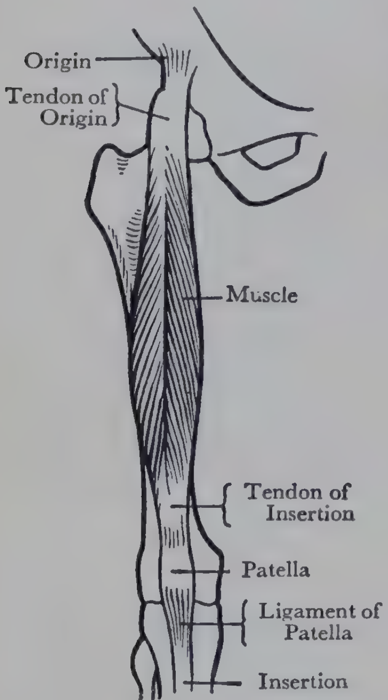


FIG. 147.—TYPICAL ATTACHMENTS OF A LONG MUSCLE BY TENDONS

The muscle shown is the principal extensor (straightening) muscle of the knee

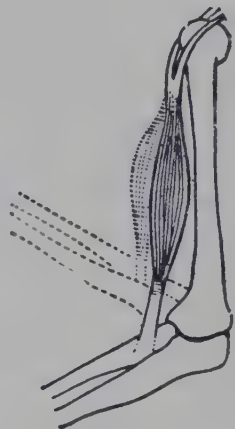


FIG. 148.—DIAGRAMMATIC REPRESENTATION OF ACTION OF BICEPS

Dotted lines show changes on muscle contraction

cases there is considerable swelling due to bleeding, severe pain, and inability to move the part injured. A common example is the sudden pulling of the muscle of the calf when playing games.

Treatment consists of cold application, rest, and support. Cold is applied by means of a **cold compress**

(handkerchief, towel, or a piece of linen soaked in cold water), as described at page 77. **Rest** and **support** by a sling in the case of an upper limb, and by a crutch or stick for the lower limb. A bandage or adhesive plaster applied firmly over the injured part helps by compression to limit the swelling and to relieve any pain.

JOINTS

1. Structure and function of joints

A joint or articulation is the connection between two or more bones. Its function is to cement together two adjoining bones, or to hold two bones together and yet permit movement between them.

2. **Parts which enter into the formation of joints** are:

(i) The ends of **two or more bones**.
(ii) The **cartilage (or gristle)** which covers the ends of the bones.
(iii) The **capsule**, which is a thick, strong enveloping bag holding the bones together.
(iv) The **ligaments**, which are bands of thickened capsule so arranged as to strengthen the joint.
(v) The **synovial membrane** lining the inside of the joint capsule; this membrane secretes a fluid which lubricates the joint surfaces.

3. **Types of joints.** There are two main types of joints, immovable and movable.

(i) **Immovable joints** occur between the bones of the skull, pelvis, and elsewhere. In the skull, several of the bones fit together like pieces of wood that have been dovetailed, and no ligaments, synovial fluid, or articular cartilage take part in the joint (Fig. 110). The sacrum is separated from the ilium by a layer of cartilage which acts as a buffer; ligaments surround this joint, but there is no synovial membrane or fluid in it (Fig. 114).

(ii) **Movable joints** are exemplified in the limbs. As the

movements required at one joint differ from those a
another, there are different types of movable joints. A
ball-and-socket joint (Fig. 149) allows movement i
many directions, as occurs at the hip- and shoulder
joints.

A hinge joint (Fig. 117) allows movement in on
plane only. The knee- and elbow-joints, at which

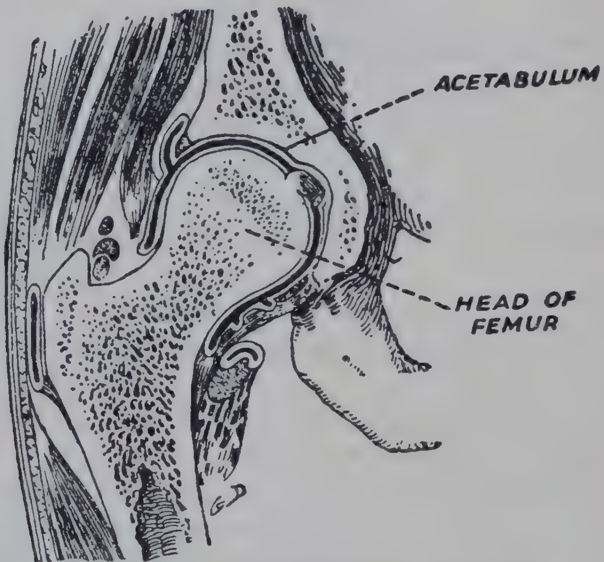


FIG. 149.—SECTION OF RIGHT HIP-JOINT

Ball-and-Socket joint

there is only flexion and extension, are hinge joint
Gliding joints allow a small amount of movement onl
These are exemplified by the small joints between th
bones of the wrist and foot and in the spine. Th
common injuries to joints are sprains and dislocation
Both may be associated with fractures.

SPRAINS

A sudden wrench or twist at a joint may cause a tea
of the tissues outside the joint or of the ligaments of th
joint. If this occurs without any displacement of th

bone, the condition is called a sprain.

A sprain of the ankle (Fig. 150) is not uncommon.

1. **Symptoms**

(i) A severe pain at the time of the injury.
(ii) Swelling.
(iii) Loss of movement in the joint.

2. **Signs**

(i) Swelling over the joint.
(ii) Painful and restricted movement on attempting to bend the joint.

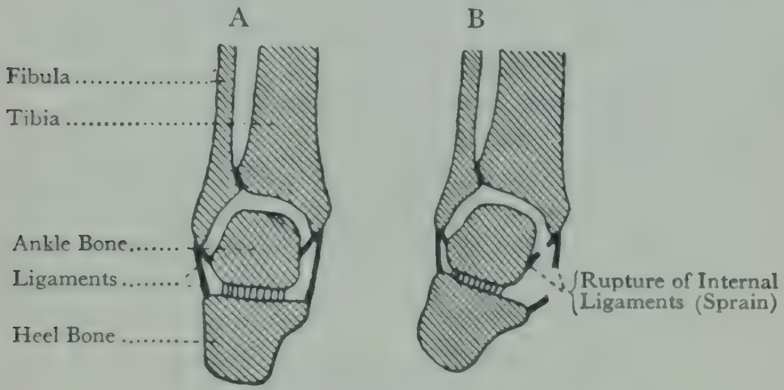


FIG. 150.—SECTION THROUGH ANKLE-JOINT
A, Normal ankle B, Sprained ankle

(iii) Discoloration, due to effusion of blood. This is not seen immediately after the injury, but when present may persist for weeks.

. **General principles of first aid treatment**

First aid consists mainly in **rest, support** of the injured art, and application of **cold compress**. It is often ifficult to tell whether a patient has a sprain, dislocation, r fracture, and **if in doubt, treat the condition as a racture**. As a general rule, **footwear should not be emoved** for injuries around the ankle, unless there is welling of the foot or a long riding-boot is being worn: n the latter case subsequent swelling would make the

removal of the boot very difficult. A boot or shoe is a excellent splint and sufficient relief from swelling ca usually be obtained by loosening the lace.

Treatment depends on where the patient is, what for of footwear is worn, and whether or not it has been remove before the first-aider's arrival, and the transport availab to take the patient home or to a doctor.

(i) **If the patient has a shoe on and medical assis-ance is not available :**

(*a*) **Do not remove the shoe**, unless there is muc swelling or a bad cut.

(*b*) Dress and **bandage** the foot if necessary.

(*c*) Transport the patient, **with the leg raised**, in car to the doctor.

(ii) **If the shoe or boot has been taken off :**

(*a*) **Remove the sock.**

(*b*) Take a **thick layer of cotton-wool** and cov the whole foot, except the toes. Bandage firml When the wool is nearly covered by the bandag place another piece of wool on top and continu bandaging over it. This limits the amount swelling and keeps the part at rest.

(*c*) If cotton-wool and bandage are not availabl wrap the ankle and foot in a **towel wrung ou in cold water** and place a cold wet sponge ove the painful area.

(*d*) Keep the **leg and foot raised**.

(*e*) Get a **doctor** to see the injury as soon as po sible.

(*f*) **Do not bandage an elderly patient's ank tightly** for this or any other condition, as th circulation may be seriously interfered with.

(iii) **If the boot has been taken off and wool ar bandages are not available :**

(*a*) Improvise dressings and bandages from handke-chiefs and ties. Place a handkerchief as a p over the painful area and firmly apply an ank bandage (pages 107–108).

(*b*) If cold water is available, the bandage can be saturated with it. This will relieve pain and tighten the bandage.

(*c*) Do **not** let the patient **walk** on the injured ankle until a doctor has seen it.

(*d*) If there is **doubt about a fracture**, the part should be splinted.

(*e*) Keep the patient's **leg raised**.

(*f*) Transport him quickly to a **doctor**.

Sprained knee (football knee). The symptoms are pain, usually at the inner side of the knee, and inability to move it freely; it is 'locked'. Lay the patient down and raise the leg. Take a large piece of cotton-wool and surround the joint with it and bandage it with a roller bandage, triangular bandage, or a substitute. Apply nore wool and rebandage.

If the patient is capable of walking, he may be allowed o do so for a short distance.

Arm sprains. If a joint of the arm is injured, the imb should be put in a sling.

DISLOCATIONS

A dislocation is a displacement of one or more bones t a joint. There is usually tearing of the capsule and gaments of the joint, and often the muscles around are ijured.

The joints most frequently dislocated are the shoulder n adults), elbow (in children), lower jaw, thumb, and ngers.

The shoulder-joint is readily dislocated, as it is of the all-and-socket variety, and the socket is shallow like a ucer. This socket fails to hold the rounded head of the umerus in place when great violence is applied to the int (Fig. 116). The injury generally occurs when conderable violence is applied to the elbow or the hand, hile the joint is in a position of strain. Thus dislocation

of the shoulder may occur from a heavy fall on to the ha
when the arm is stretched rigidly forwards.

In the lower limb, dislocations without fractures a
uncommon.

1. **Symptoms**

(i) Pain at or near the joint is severe.

(ii) The joint feels useless and fixed.

2. **Signs**

(i) Deformity is seen in comparison with the correspon ing joint on the opposite side. The is a prominence formed by the d placed bone, and a hollow in the pla where it should be normally. Thu in the shoulder-joint, a swelling m be seen in front under the collar-bo or felt in the armpit, and there is hollow below the tip of the should (Fig. 151).

Fig. 151.—Dislocated Shoulder

(ii) Abnormal position of the limb is i variably present, the position assum depending on the joint affected a on the direction of the dislocation. the usual shoulder dislocation, t elbow cannot be brought to the side the body and the forearm is support by the opposite hand.

(iii) The usual joint movements cannot be performed the patient, nor by anyone examining the part.

(iv) Swelling occurs after a few hours, owing to the inj to small blood-vessels.

3. **Treatment**

Do not try to put the bone back in place.

(i) In the case of a **dislocation of the shoulder**:

(*a*) **If out of doors: Support the limb** in position most comfortable to the patient, so t any jarring during transport is limited. Move limb as little as possible. **Loosen the clothi**

round the injured joint. Place a pad of folded newspaper, a cloth, or something of similar size, between the lower part of the arm and the body. **Bandage the arm to the body** with anything available, by taking the bandage over the arm and right round the chest. Bandage the forearm in whatever position the patient finds most comfortable. Take the patient to the doctor.

(*b*) **If indoors :** Send for the **doctor**, and in the meanwhile **remove the clothing** from the upper part of the body, taking the sound arm from the sleeve first. If removal of clothing is painful, cut up the seams. Put the patient **to bed, supporting the limb on pillows** in a comfortable position. **Do not give him anything to eat**, as he will require an anaesthetic. **Apply a towel wrung out in cold water** over the injured joint.

Dislocation of the shoulder may occur repeatedly after slight injury. Under such circumstances the patient may have learnt the knack of how to reduce it. In all cases the first-aider should help the patient to the doctor and not attempt any manipulation of the joint.

(ii) **Elbow-joint.** Dislocation is more common between the ages of 15 and 25 than later. Treat by application of a large arm-sling and take the patient to the doctor.

(iii) **Dislocations of the hip- or knee-joint** are very rare and **serious injuries**. If suspected, the case should be **treated as a fracture of the femur** by tying the lower limbs together or by the application of a long outside splint. Careful transport to hospital or a doctor should be undertaken without delay.

(iv) The **lower jaw** may be dislocated by yawning or by a blow on the chin when the mouth is open. If the patient is wearing **false teeth** these should be **removed**. Then take the case to the **doctor** or hospital.

(v) **Compound dislocation.** If any bone protrudes

through the skin when it is dislocated, the dislocatic is compound. It is a serious injury.

Dress the injured skin and protruding bone wi any clean dressing that is available. Cover this wi cotton-wool, and fix the limb in the position mc comfortable for the patient before he is transporte to a **doctor or hospital** for further treatment.

CHAPTER XVIII

EAR, EYE, AND NOSE

THE organs of special senses are five — the ears, eyes, nose, the touch corpuscles in the skin, and the taste buds at the

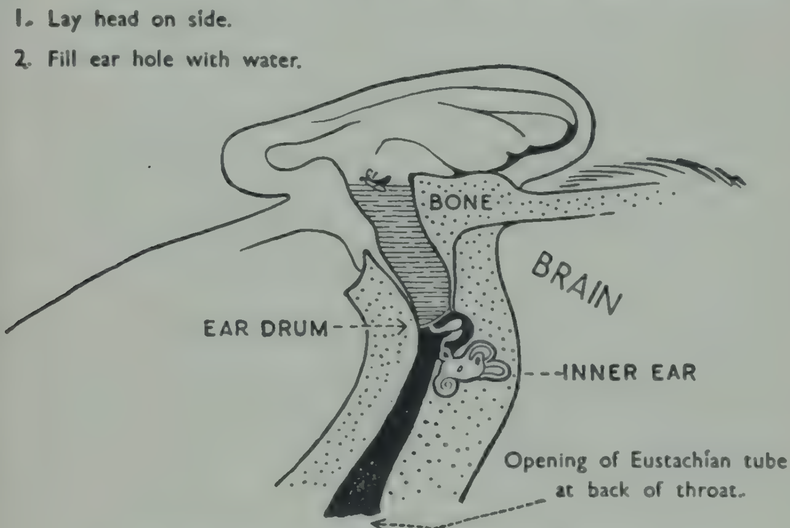


FIG. 152.—FLOATING AN INSECT OUT OF THE EAR

back of the tongue. The skin and the tongue are dealt with in Chapters XIII and XX respectively.

THE EAR

. **Structure and function.** The ear consists of three main parts — external, middle, and internal (Fig. 152).

(i) The **external ear** comprises the portion seen on the outside of the head and the earhole **(external meatus)**, also the canal passing inwards and slightly forwards

for about $1\frac{1}{4}$ inches to the delicate membrane calle the drum **(tympanic membrane)**. The audito canal is lined with hairs and wax-producing glan designed to keep out insects and small foreign bodie The function of the external ear is to pick up ar transmit sound waves to the internal ear, the first st of which is to set the delicate drum in vibratio Projecting ears are an asset to hearing if not to beaut

(ii) The **middle ear** is a small, air-containing cavity the temporal bone, lying between the drum and inn ear. It is bridged by three very small bones, joine and placed in such a way as to magnify sound wav transmitted to them by vibrations of the drum. T bones pass these magnified sound waves to the flu in the inner ear by vibrations. A small tube lea from the middle ear to the back of the throat: th opens when a person swallows and so allows air enter or leave as required to equalise the air pressu on either side of the ear-drum. If the back of th throat is inflamed as with a ' cold ', the opening this tube often becomes blocked and the air pressu in the ear suffers, with the result that there is tempora deafness as vibrations are interfered with. This co dition may become serious, especially if a person fl while suffering from a cold, as the great variations the atmospheric pressure outside the ear-drum cann be properly adjusted inside the drum. At all times is advisable to swallow vigorously during ascent a descent in an aircraft to help ' clear the ears '.

(iii) The **internal ear** is embedded in the inner part the temporal bone and consists of two parts, one co cerned with balance **(semicircular canals)** and t other with hearing **(cochlea)**. The cochlea is t actual organ of hearing and consists of a small coil tube containing fluid, which surrounds a number minute structures like the keys of a piano. Here t sound waves are analysed into their various wa lengths and pass to the brain by means of the fib

of the nerve of hearing **(auditory nerve)**, somewhat after the manner of the wires of a piano. The brain interprets these sounds, and stores them as memories or records to be played over again as required.

The first-aider will, therefore, appreciate the delicacy of this hearing apparatus and the need to limit first aid treatment to the external ear and refer all cases to a doctor. Ears should **never be probed**, and **only syringed under a doctor's instructions**.

2. **Ear injuries.** The commonest ear conditions encountered are aches, bleedings, discharges from, and foreign bodies in the ear.

(i) **Ear-ache** may be a symptom of middle-ear disease. Apply warm **cotton-wool**, or a muffler, or a scarf, and send the patient to a **doctor**. In remote places where there is no doctor or nurse, temporary relief may be given by applying to the earhole a few drops of olive or **castor** oil, but **never do so if there is any discharge**.

(ii) **Bleeding from the ear** may accompany fracture of the skull (see under Internal Haemorrhage, page 51) or follow rupture of the drum by bomb blast. Cover the ear with a cotton-wool pad and bandage, keep the patient flat with head slightly raised and turned to the bleeding side. Refer the patient to a **doctor** as soon as possible.

(iii) **Discharge from the ear** usually indicates a damaged ear-drum. **Cover with cottton-wool** and take patient to a **doctor**. Inserting wool in the earhole may be dangerous. **Never use ear drops or a syringe** for such a condition.

(iv) **Foreign bodies in the ear:**

(*a*) **An insect** may get in the ear. It can be **floated out** by laying the head on one side with the affected ear upwards and filling the earhole with water, castor oil, or olive oil (Fig. 152).

(*b*) **Pencils or straws** are sometimes put into the

ear by children. If the end can be readil **grasped**, do so **gently** and withdraw the objec If it cannot be removed easily, take the patien to a **doctor** and be careful to see the patient doe not touch the foreign body else the drum may b damaged. Tie the hands down if necessary.

(*c*) If a **pea, bead**, or **button** is lodged in the ea take patient to a **doctor at once**. Do not try t remove it, as it is likely to be pushed further i and injure the drum. Do not add any fluids, a they are liable to make the object swell and th condition worse.

THE EYE

1. **Structure and function.** The **eyeball** is about th size of a large cherry and lies in a bony cavity **(orbit** in the front of the skull. It is, therefore, well protecte from injury by bone, except in front where, during wakin hours, it is covered by the eyelids, which leave only a smal portion of the eyeball visible. Should any foreign bod attempt to enter the eye, the eyelids with their sensitiv lashes flick together to keep it out. Further protection i given by the tears, which wash the front of the eyeball. These tears are formed in a gland **(lachrymal gland)** under th outer part of the upper eyelid, and flow across the eye t the inner corner where they drain away through a smal opening in the lower lid to enter the nose. That explain why people wipe their noses when they are cryi silently at the cinema. There is always a mild activity the tear glands, so that in health the eyelids move free and the front window of the eye is always kept clean an glittering. The tears are salt, like normal saline, and th gives a clue to the best type of eye-wash. The under si of the eyelids and the visible part of the eye are cover by a thin transparent membrane **(conjunctiva)**, whi forms a sac to protect the eye and spread the tears ever over it (Fig. 153).

The eyeball is covered by a tough, white membrane called the **sclerotic**, except in front where there is a transparent membrane **(the cornea)**. Behind this is an aperture **(the pupil)** to transmit light on to the **lens**, which is suspended between two chambers — the front and back chambers of the eye. These chambers contain special fluids **(humours)**. The lens focuses light on a black lining **(retina)** at the back of the eyeball after the fashion of a camera lens, the retina taking the place of the camera film.

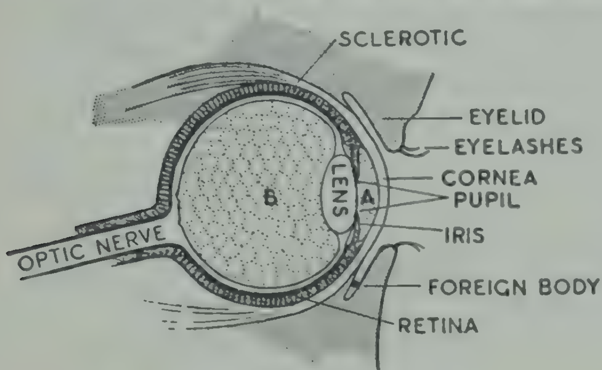


FIG. 153.—SECTION OF THE EYE
A, Anterior chamber B, Posterior chamber

This photographic picture is transmitted to the brain by the large **optic nerve**, which is formed by nerve fibres from each cell of the retina.

The eyeball, like a camera, has a further refinement in the shape of an adjustable diaphragm or stop: this is attained by the coloured part of the eye or **iris** (which may be blue, grey, or brown) contracting or dilating to make the pupil larger or smaller as required. This action of the iris is affected by certain conditions of the body functions and by some drugs, so that the size of the pupil and its reactions to light should be noted to report to the doctor in case of unconsciousness.

2. **Eye injuries.** The points for the first-aider to bear in mind are that the transparency of the eye must be maintained and that it is very dangerous to try to remove

anything from the eye that cannot be flushed away easily with a bland fluid that will not hurt the delicate conjunctiva. Moreover, damage to the cornea might lead to infection, which could rapidly spread through the fluids in the eyeball and destroy not only the affected eye but also spread to the other — a peculiarity of the eye.

(i) **Black eye** is a bruise (see page 49). Apply a cold compress, using water only. **Never put spirit in a compress for the eye.**

(ii) **Corrosives or chemicals in the eye** are liable to occur particularly in chemical works, where special eye-wash solutions have to be provided under the Factories Act (see page 73), and from phosphorus in incendiary bombs (see page 143). The main thing is to **flush the eye thoroughly with water** and apply a moist dressing.

(iii) **Cuts and wounds about the eye** require treatment by a **doctor**. Apply a **clean dry dressing** and bandage. **Never apply an antiseptic**, unless under the doctor's instructions.

(iv) **Foreign bodies in the eye.** The commonest foreign bodies in the eye are dust, eyelashes, flies, and metal fragments. They should be removed as soon as possible, but there must be no persistence by the first-aider in trying to remove a fixed body. Nature's method is to flush it out with tears. Therefore encourage the patient to **blow his nose strongly** and **blink** his lids several times. **Keep him from rubbing the eye.**

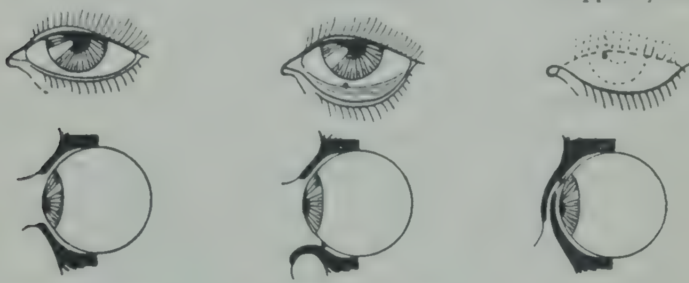
If this does not dislodge the foreign body —

(*a*) **Turn the lower lid down gently**, and, if the foreign body is visible, remove it with the corner of a **soft handkerchief** or a **moist camel-hair brush** (Fig. 154).

(*b*) If the foreign body is not seen, **pull the upper lid forward** by the eyelashes and gently slide the **lower lid under it**, when its lashes may dislodge the foreign body under the upper lid.

(*c*) If the removal is still unsuccessful, **submerge the eye** in a basin of water, the eye being blinked frequently (Fig. 155).

Normal eye | Foreign body under the lower eyelid | Foreign body under the upper eyelid



Manipulation of eyelids

Pull lower lid down by lashes to expose the foreign body. Remove grit very gently with corner of soft handkerchief or with camel hair brush

Pull upper lid forward by lashes. Slide lower lid gently up under the upper, so that lashes may wipe away the foreign body

FIG. 154.—REMOVAL OF FOREIGN BODY FROM THE EYE

(*d*) Apply **castor or olive oil drops** and **bandage the eye lightly**, if still sore, and send patient to **a doctor**.

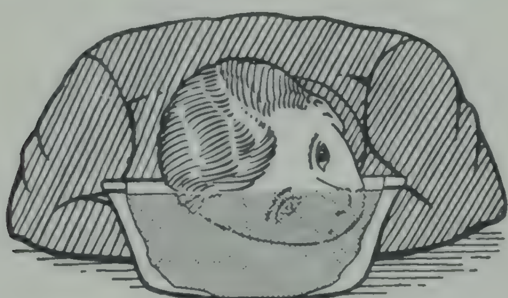


FIG. 155.—REMOVAL OF FOREIGN BODY FROM THE EYE

Submerge eye in a basin of water and blink rapidly. If this fails to remove the foreign body, bandage eye lightly and send the case to a doctor

Do not persist in trying to remove a foreign body from the eye

(*e*) If the foreign body is **embedded in the cornea**, refer the case to a **doctor** at once, a pad being bandaged lightly over the eye (Figs. 61, 84, and 85).

THE NOSE

1. **Structure and function.** The nose extends from the nostrils in front to the throat at the back, being bounded below by the roof of the mouth **(palate)** and above by the **sphenoid bone** (Fig. 110), separating it from the brain. On either side it opens into bony cavities, called the **nasal sinuses**, which may become inflamed, causing serious consequences. The membrane lining the nose is much folded (Figs. 156 and 157) and is very rich in blood-vessels to warm the incoming air, and provided with hairs at the nostrils to filter off particulate matter. In the membrane in the upper part of the nose are embedded special cells for detecting smells: these cells are connected to the brain by fine nerves, which pass through the bone at the roof of the nose. The great danger of nose infections is the close proximity of the base of the brain and the danger of infection spreading to it and to the middle ear (see page 214).

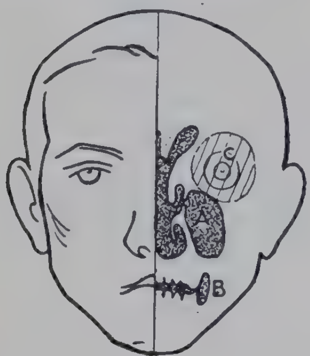


FIG. 156.—SECTION THROUGH THE FRONT OF THE HEAD TO SHOW HOW THE NASAL CAVITY IS DIVIDED BY THE TURBINAL BONES

Air-containing cavities (sinuses) in neighbouring bones are also seen. These sometimes become infected

A, Antrum B, Inside of cheek C, Orbit

2. **Nose injuries.** The commonest nasal injuries are bleedings from broken bones of and foreign bodies in the nose.

(i) **Nose bleeding or epistaxis** may be due to blows on the nose, disease, fracture of the skull, nose-picking, or high blood-pressure. The first aid treatment is given at page 50 and Fig. 27.

(ii) **Broken nose** is due to direct blows as in boxing. Arrest the haemorrhage as described under epistaxis at page 50, and send patient to a **doctor**.

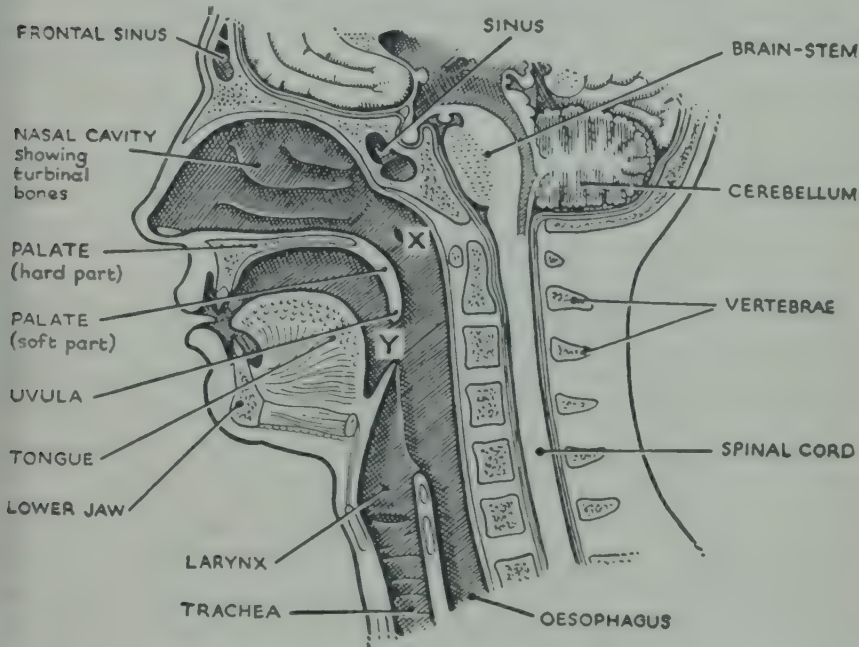


FIG. 157.—SECTION THROUGH THE HEAD AND NECK TO SHOW THE CAVITIES OF THE NOSE, MOUTH, AND THROAT. X = POSITION OF ADENOIDS. Y = POSITION OF TONSILS

(iii) **Foreign bodies** such as beads, beans, buttons, peas, and pips are sometimes introduced by children. Get the child to **blow his nose violently**, and if this fails to dislodge the article, **do not try to fish it out**, but

(*a*) instruct patient to **breathe through his mouth** and

(*b*) take him to a **doctor**.

CHAPTER XIX

BRAIN INJURIES AND STATES OF INSENSIBILITY

IN order to understand the elements of injuries of the brain and states of insensibility, it is necessary to have a little knowledge of the structure and functions of the nervous system.

THE NERVOUS SYSTEM

There are really two nervous systems, which, though distinct, work in the closest collaboration for the good of the body as a whole. One is the **cerebro-spinal system** which is under the control of the person's will, guiding thought and action, and going to sleep with the individual. The other is the **sympathetic nervous system** which functions perpetually, day and night, no matter whether the individual is awake or asleep, helping to regulate such vital functions as the circulation, respiration, digestion, and temperature: it keeps the fires of life burning while man sleeps.

1. The **cerebro-spinal system** consists of the brain spinal cord, and nerves.

(i) The **brain** almost fills the cavity of the skull. It is the great nerve centre of the body, receiving messages from outside by means of innumerable sensory nerves (from the eyes, ears, nose, and skin), and taking appropriate action through the muscles at its will. It is also the seat of the intellect and emotions. The brain consists of masses of cells and nerve fibres: the cells give the surface of the brain a greyish colour and the extent of this varies in individuals — the more

'grey matter' they possess, the greater the intellect. As man has developed mentally through the ages, the amount of grey matter has increased, and, to make room for this inside the rigid skull, the brain surface where the cells are has developed into waves: it is correct, therefore, to associate 'brain waves' with a highly developed brain and a very wavy surface. Three transparent membranes **(meninges)** surround the brain to help protect and nourish it. Between the

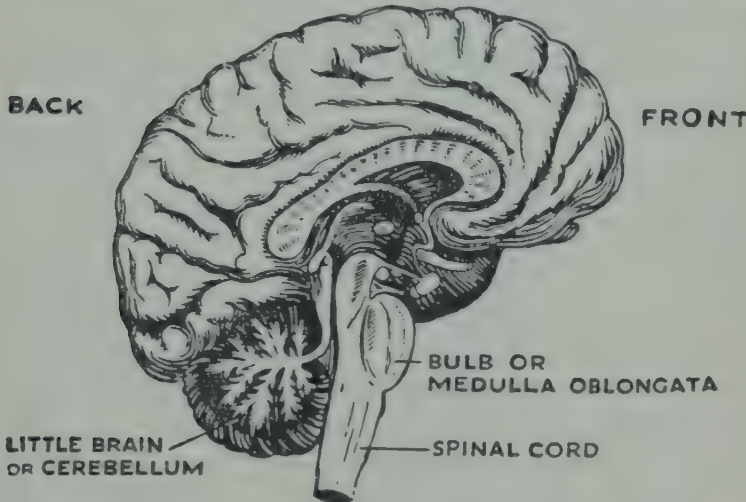


FIG. 158.—BRAIN CUT LENGTHWISE (ABOUT ½ NORMAL SIZE)

meninges and the brain there is a certain amount of fluid **(cerebro-spinal fluid)**, which acts as a water-bed to give further protection to the base of the brain against injury from jarring.

There are three main parts of the brain (Fig. 158):

(*a*) The **cerebrum**, which forms about four-fifths of the brain, and is the intellectual and operative centre where impressions are stored and action is chiefly taken. It is divided into halves, the right and left hemispheres, controlling the two sides of the body: the right hemisphere controls the left side, and vice versa.

(*b*) The **cerebellum** or small brain, about the size of a tennis ball, lies at the back of the brain underneath the cerebrum. It is chiefly concerned with co-ordination of movements and balancing.

(*c*) The **medulla oblongata** is a tapering, stalk-like structure lying at the base of the brain and continuing into the spinal cord through the large opening **(foramen magnum)** at the bottom of the skull. It contains the vital centres, such as those which regulate circulation, respiration, and the body temperature.

(ii) The **spinal cord** is a cylindrical structure of nerve tissue, about $\frac{1}{2}$ an inch in diameter and 20 inches in length, extending from the medulla oblongata at the foramen magnum to the second lumbar vertebra (Fig. 159). It lies protected within the spinal canal formed by the bony arches of the vertebrae.

The cord is the channel by which sensory and motor messages are transmitted to and from the brain. If it is cut across, as by a severe fracture-dislocation of the spine, there follows loss of sensation and paralysis of the muscles of those parts of the body supplied by the nerves coming off the spine below the level of the injury. Like the brain, the spinal cord is surrounded by membranes containing cerebro-spinal fluid. Inflammation of the membranes of the brain and cord is termed **cerebro-spinal meningitis**.

(iii) The **nerves** consist of cells situated in the brain or cord and long white fibres joining these cells with the nerve-endings in the muscles, skin, and the sense organs, such as the ear, eye, nose, and tongue. Nerves come off from the central nervous system in pairs, and are grouped as cranial and spinal.

(*a*) **Cranial nerves.** The brain gives off 12 pairs of nerves, which leave the skull through openings in the base and supply mainly the structures of the head and face, including the organs of special

sense. Thus one pair, the **olfactory nerves**, pass to the nose and are concerned with smell. Another pair, the **optic nerves**, are connected with the eye

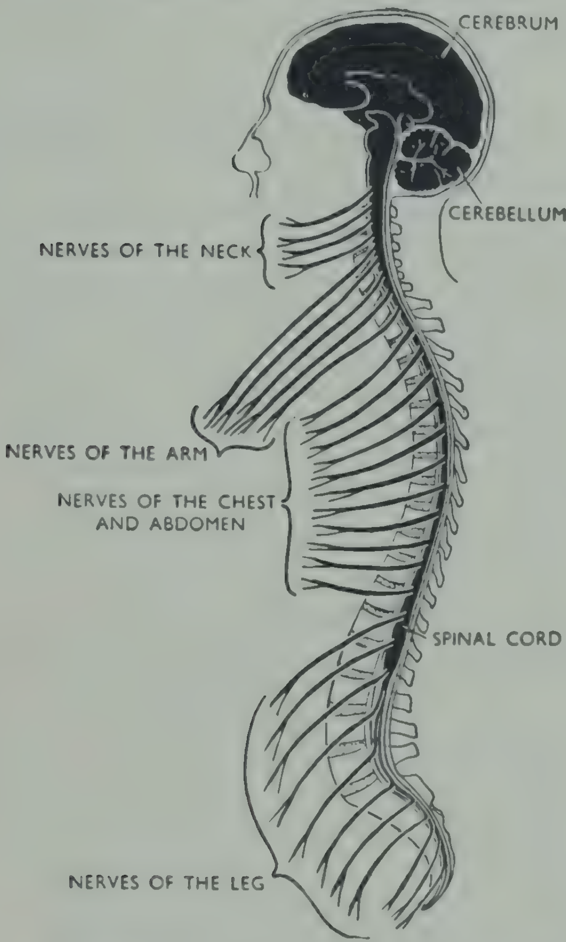


FIG. 159.—SIDE VIEW OF THE NERVOUS SYSTEM

and vision, and the **auditory nerve** with the ear and hearing.

(*b*) The **spinal nerves** are called cervical, dorsal, lumbar, sacral, and coccygeal, depending on the section of the spine from which they arise. There are 31 pairs of spinal nerves in all. These nerves

pass out from the spinal column between eac pair of vertebrae to supply the skin, muscle joints, and organs of the body and limbs.

Sensory nerves convey messages to the spina cord and brain, and motor nerves transmit order for appropriate action by muscles, etc. All in coming messages are not dealt with by the brai or Commanding Officer: certain routine matte are disposed of by centres in the spinal cor comparable with junior officers. Such routin responses to sensory stimuli are termed **refle actions**. For example, if you accidentally pric your finger with a needle, you automatically dra away your hand, no thought being needed: eve a newly-born baby will react in this way. Stimul that require voluntary reaction are referred to th brain. Complicated reactions as are needed i swimming or driving a car lead to considerabl fatigue during the learning stage, but not so whe they are mastered, for then the brain hands ove most of the work to the spinal cord.

2. The **sympathetic nervous system** consists of a chai of nerve centres most of them being sited on either side o or in front of the spinal column. Nerve fibres from the enter the various nerves of the body to control such auto matic functions as the dilation and contraction of blood vessels, movements of stomach and intestines, the beatin of the heart, and the rate and depth of breathing. Th sympathetic nervous system is controlled by the brain an influenced by the emotions, but not by the will.

UNCONSCIOUSNESS AND ALLIED CONDITIONS

The commoner causes of unconsciousness and allie conditions likely to be seen by the first-aider are **A**poplex **A**lcoholism, **A**sphyxia (see list of causes of suffocati at page 61), **E**pilepsy, **I**ncreased **I**ntra-cranial pressu

(*e.g.* cerebral haemorrhage), **O**pium poisoning, **U**raemia from kidney diseases, diabetes, fainting, and heat stroke. Unconsciousness may be due to the brain being knocked out of gear by jarring from a blow on the head, leading to concussion either with or without fracture of the skull, or to increased pressure inside the rigid skull. For example, haemorrhages inside the skull, which is almost completely filled by the brain and its membranes, even when small in amount have a marked effect on consciousness and other functions of the body. When the skull is fractured there is often both concussion from the blow and pressure on the brain from the bleeding and the displaced bone. Again, the activity of the brain is dulled by a lack of oxygen as occurs in fainting, or the brain-cells may be drugged and put to sleep by poisons in the circulation, whether they are produced in the body as in diabetes and kidney disease (uraemia), or introduced from outside as may occur with alcohol, opium, sleeping draughts, certain mushrooms, and berries (deadly nightshade). In addition, sudden unconsciousness may occur as the result of heat effects, meningitis, and cerebral malaria, while the hysterical individual may mimic the condition.

It will be seen that the diagnosis of an unconscious condition is a very complicated matter that can only be undertaken by a doctor. The first-aider, therefore, should concentrate his attention on general first aid treatment applicable to all these conditions with a view to preventing them becoming worse. In some instances the cause of the unconsciousness may be evident, as in the case of a fractured skull or the finding of a bottle of poison. When the cause of the unconsciousness is known special first aid measures can be taken.

Observations should be made, however, to report the general circumstances to the doctor either when he arrives or on the telephone, so that he can use the information to make a diagnosis to guide the treatment. The points which should be specially noted are:

(1) Was the **onset** sudden or gradual?

(2) Was there a **fit**? If so, what part of the body was affected first, and did it spread and how?
(3) What is the patient's **appearance** — pale, flushed, bluish?
(4) What are the **pulse and respiratory** rates, and the type of breathing? Whether shallow, deep, laboured, etc.
(5) What is the state of the **pupils** — dilated or contracted, equal or unequal, do they react to light or not?
(6) Is the patient semi-conscious **(stuporose)** or completely unconscious **(comatose)**? To decide this point, it should be noted that those in stupor can be roused and their pupils react to light when the eyelids are opened; further, they object to having their eyes opened; whereas a comatose patient cannot be roused, and his pupils do not react to light.
(7) Is there any **wound** or evidence of a **fall** or **blow**?

FIRST AID TREATMENT OF UNCONSCIOUSNESS

1. **General rules.** If in doubt whether the casualty is dead or alive, err on the safe side and treat as though still living. The early **signs of death** are absence of pulse and breathing, and loss of lustre of the eyes.

(i) Send for a **doctor immediately**.
(ii) Lay the patient **flat** on his back with his head to one side, and remove any **false teeth** to ensure a clear air-way.
(iii) **If breathing has stopped**, **apply artificial respiration at once.**
(iv) **Raise the head** slightly, if the face is **flushed** (Fig. 160).
(v) **Lower the head** and raise the feet, if the face is pale (Fig. 160).
(vi) **Loosen the clothing** at the **neck** and **waist**.
(vii) Keep all cases of unconsciousness warm and **treat for shock**, except those due to heat stroke.
(viii) Ensure a **sufficient supply of air** by opening

windows indoors, and keeping the crowd away if out of doors.

(ix) **Do not give fluids or food** by the mouth while the patient is unconscious, as the material might enter the windpipe instead of the gullet; when consciousness is regained, he may be given sips of water, hot tea, or coffee, but do not give any solid food until ordered to do so by the doctor.

(x) Protect the patient **from the weather** as best you

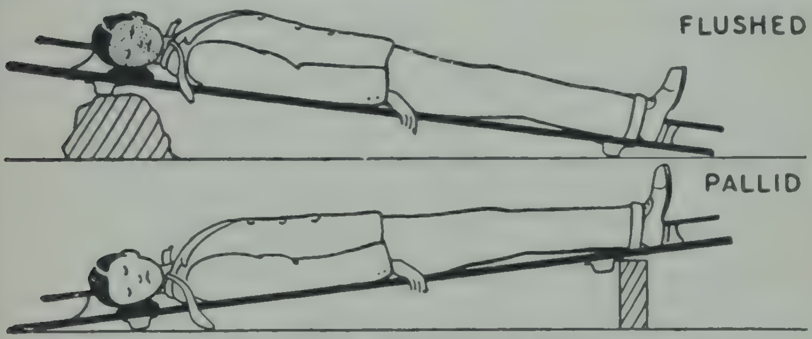


Fig. 160.—Postural Treatment of Unconsciousness

can, until he is fit to be **removed** to some shelter as a **stretcher case**.

(xi) Treat any **special cause** of unconsciousness, if it is known.

(*a*) **Bleeding** should be treated immediately.

(*b*) **Fractures** of limbs should be supported to immobilise them, but extensive splinting and dressing of wounds should not be undertaken until consciousness has returned and the general condition of the patient is satisfactory.

2. In **alcoholic coma** there is usually information available from relatives, friends, or witnesses as to the nature of the case. Remember, however, that a drunken person may be suffering from head injuries from a fall or blow. Treat on the general lines just given and encourage vomiting by administering a drink of salted water or other emetic (see page 251).

3. **Apoplexy or cerebral haemorrhage.** If an elderly person falls down suddenly and becomes unconscious, blue in the face, with deep noisy breathing and a slow pulse the condition is most likely to be due to a cerebral haemorrhage. Treat on the general lines already described. (See also pages 52 and 53 of Chapter VI on Internal Haemorrhage.)

4. **Asphyxia** or suffocation is a common cause of unconsciousness, whether the result of inhaling toxic gases, or to near drowning, or to strangulation. Treat by removing the cause or the patient from the cause, and applying artificial respiration and general measures as described in Chapter VII, pages 67–72.

5. In **concussion**, or stunning, there is sudden loss of consciousness and failure of the heart. It follows a blow on the head causing jarring of the brain. There may be a fracture of the skull or no visible sign of external injury. The history of the case as obtained from witnesses, or the appearance of the surroundings, or the state of the patient's head, usually give the clue to the condition. There is insensibility of varying degrees, which may last merely a minute or so or for several hours. The face is pale, the limbs are relaxed, and the pulse and respiration are slow. Vomiting may occur as the patient is regaining consciousness. It is important, therefore, to keep the head to one side so that the vomit will not enter the windpipe. Treat on general lines, and when he recovers do not let him walk or even sit up. He should be kept flat and quiet until seen by a doctor.

6. **Compression of the brain** is usually due to bleeding, blood-clot, or a depressed piece of bone pressing on the brain. Unlike concussion it does not come on for several hours after the injury. There is headache and drowsiness, which passes into unconsciousness. The pulse and respirations are slow, and the pupils are unequal. This condition is very serious and any case of head injury developing such symptoms should be **referred to a doctor immediately**

as an urgent operation may be needed to save life. Meanwhile, the case must be treated on general lines. It is important to keep the fractured part of the skull uppermost.

7. **Convulsions in children** are apt to occur when they are suffering from fever or gastric disturbance, especially those who are rickety. The fits come on suddenly, the eyes becoming fixed, the face going purple, and the limbs and body stiffening. This may last a few minutes before the child as suddenly relaxes. When the fits cease, the child becomes very drowsy.

First aid treatment consists in

(i) Wrapping the child in a **warm blanket** in bed, when it will probably go to sleep.

(ii) Sending for the **doctor**, as the underlying condition (fever or gastric trouble) needs attention.

There is no need to give the child a hot bath ; placing it in a warm bed is sufficient and simple. However, the warm bath is recommended by some, as it helps to soothe the anxious mother, who feels that something spectacular should be done.

8. **Diabetes.** Unconsciousness may occur suddenly in diabetic patients, but this is not due to the diabetes (diabetic coma) but to **overaction of the insulin** given to treat the case. The patient has either taken too big a dose of insulin or has missed a proper meal, or has been over-exercising. The skin is moist, the limbs may tremble, and the patient may appear to be drunk. Act quickly before the patient becomes comatose. Rouse him and get him to swallow **2 or 3 knobs of sugar**, dissolved in a little water if necessary. Get a **doctor**, as further advice on treatment is urgent (see also page 24).

9. **Drug coma** is dealt with in Chapter XXI on Poisoning, pages 249 to 253.

10. **Epilepsy** is a disease of the brain and usually begins in youth and may continue throughout life. The sufferer knows when an attack is coming on, as he either hears

noises or sees a flash of light. Suddenly he falls down unconscious, his whole body shaking in violent spasms. His eyes and tongue protrude, and he grinds his teeth and foams at the mouth. He is liable to bite his tongue. The spasms of the respiratory muscles lead to temporary asphyxia, so his face becomes livid. He may pass urine during the fit. After a few minutes, the fit usually subsides and he falls asleep to awaken later, confused and with no idea what has happened. During a fit, an epileptic is liable to hurt himself badly in his fall and subsequent spasms, as he has no control of himself.

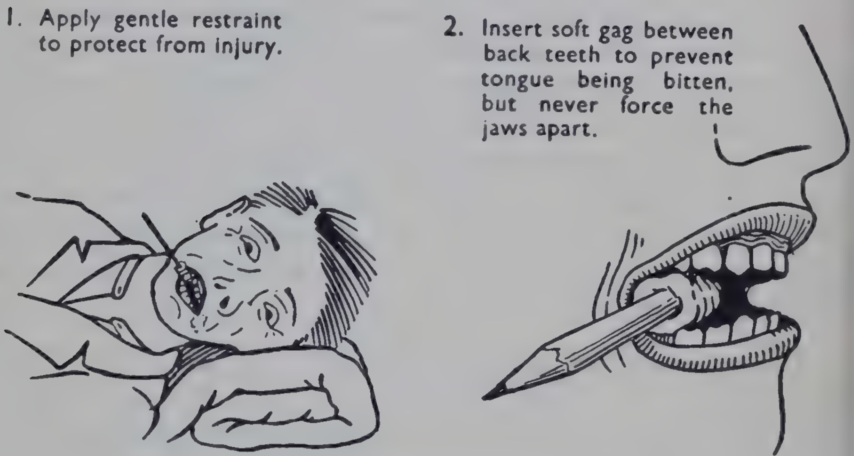


FIG. 161.—TREATMENT OF EPILEPTIC FIT

First aid treatment consists of preventing the patient from injuring himself.

(i) **Remove** the sufferer **from possible danger**, such as machinery, fireplaces, furniture, cliffs, and falling masonry.
(ii) **Lay** the patient flat with his **head to one side**.
(iii) **Insert a gag** between the back teeth at one side of the mouth to prevent the tongue from being bitten, **but never force the jaws apart**. A knotted handkerchief or pencil covered by a handkerchief serves as a gag (Fig. 161).

(iv) **Loosen clothing** at his **neck** and **waist**.
(v) Prevent injury by **gentle restraint** and by putting a coat or cushion under his head.
(vi) Cover the patient and **allow him to sleep** when the fit is over.
(vii) Report the case to a **doctor**.

11. **Fainting or syncope** is due to an insufficient supply of blood to the brain as a result of disturbance of the nervous control of the circulation. Emotion, fatigue, fright, haemorrhage, and pain are apt to cause a faint. The face is pale and beads of sweat appear on the brow; the individual becomes limp and slumps to the ground; the pulse is rapid and the breathing shallow. The treatment is similar to that for primary shock and has been dealt with in Chapter III, at pages 20 and 21.

12. **Fracture of the skull** is a severe condition resulting generally from a blow or a fall on the head. The scalp may or may not be bruised or cut. The immediate signs and symptoms are those of concussion (see page 230) and may be followed later by those of compression (see page 230) from haemorrhage or displacement of bone, as in a depressed fracture. A fracture of the top of the skull is usually accompanied by a wound of the scalp, but in fractures of the base of the skull there is frequently no visible head wound, though there may be a little bleeding from the mouth, nose, or ears. (See also Chapter VI, pages 50 and 51.)

First aid treatment should be on general lines as for compression of the brain, care being taken to see that the patient does not lie on the fractured part of the skull. A ring-pad should be applied over the wound (Figs. 59 and 60).

13. **Heat stroke or sunstroke** is due to exposure to excessive heat or to the rays of the sun, particularly in individuals who are over-clothed or heavily burdened, as when marching in formation. It is most likely to occur on a hot, humid, and still day, as this interferes with the normal

evaporation of sweat, which is nature's way of cooling t
body. The condition may start during or after exposu
to the heat. It is most frequently seen in warm climat
and in those engaged in stoking furnaces. The first sta
of heat stroke is a dryness of the skin, an inability to pa
urine, and general irritability. This may be followed
the sudden onset of unconsciousness, the face being ve
flushed, the breathing noisy, the pulse fast and boundin
and the temperature raised several degrees (103–1
degrees F. or more).

First aid treatment must be prompt.

(i) **Remove** the patient **from the heat** to as cool possible a place.

(ii) **Strip** the patient to the waist in mild cases, complete in severe ones.

(iii) **Sprinkle** the body with **cold water**.

(iv) **Fan** to evaporate the water off the body and so lea to its cooling.

(v) When conscious, give **copious draughts of co** **water** containing a saltspoonful of common **salt** to tumblerful of water.

(vi) On recovery keep the patient at **rest** and **in the coo**

14. **Hysterical fits** occur usually in young wome
following some emotional upset. They laugh, cry, or shou
and throw themselves about in various ways, always bei
very careful not to hurt themselves. They may fei
loss of consciousness, but the pupil reflex is brisk. They
not bite their tongues or pass urine as may an epileptic.

Treatment consists in either **ignoring them or bei** **very firm** with them. Never sympathise with them or t condition will worsen. The best treatment, though r official, is to smack them hard or pour cold water on th endeavours.

CHAPTER XX

THE ABDOMEN

THE abdomen contains the organs of digestion, and the internal urinary and genital organs; also the spleen. The organs of digestion include the stomach, intestines, and two special organs, the pancreas and liver (Figs. 162 and 163).

THE DIGESTIVE SYSTEM

1. Anatomy and function

Before the food which is taken into the body can be properly utilised it has to be digested in the alimentary canal, absorbed through the gut wall, and then assimilated into the tissues.

(i) The **alimentary canal** (Fig. 162) is some thirty feet long, beginning at the mouth and ending at the anus. It consists of

(*a*) The **mouth** with its **teeth** to grind the food into small, digestible morsels, and three pairs of **salivary glands** which produce the spittle or saliva to moisten the food to help it to slide down the gullet. The **tongue** aids in the swallowing process, but what is more important is its sense of taste, performed by highly sensitive cells sited at the back of the tongue. The **throat** is a cavity which lies behind the tongue and receives the food when sufficiently masticated: it has powerful muscles to reject or vomit any unacceptable material, particularly hard objects like pieces of bone.

(*b*) **The gullet or oesophagus** is a muscular tube

about a foot long and links the throat **(pharynx** with the stomach. It lies just behind the windpip in the first half of its course, and, continuing dow

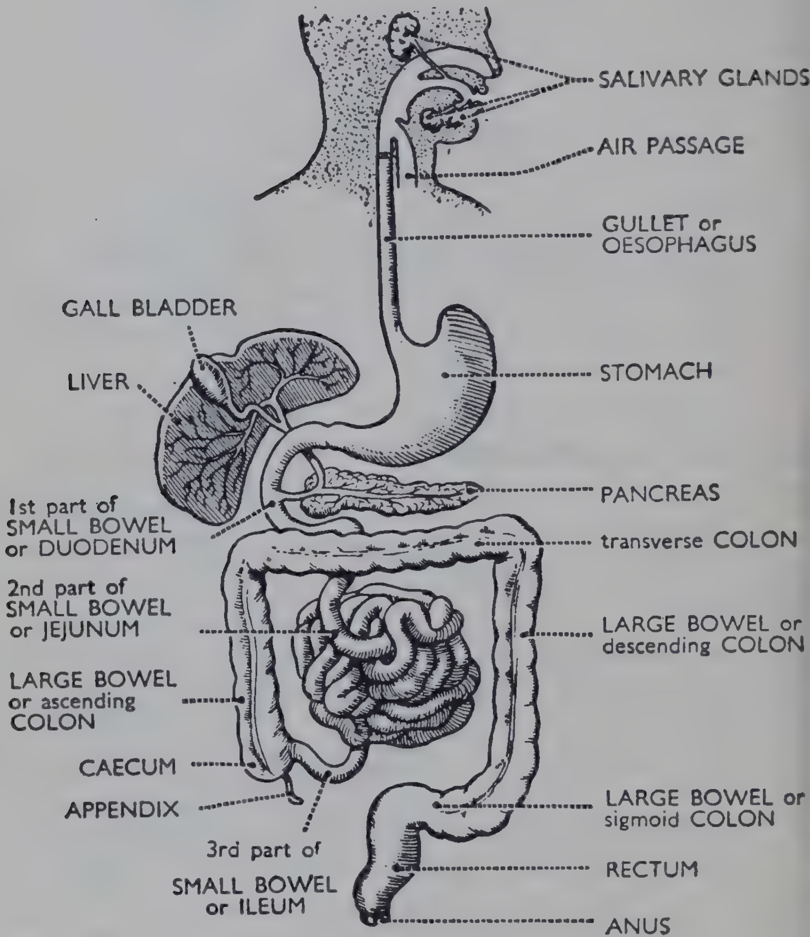


FIG. 162.—DIAGRAM OF THE DIGESTIVE SYSTEM

in front of the spine, enters the abdomen through hole in the diaphragm, immediately below the hea

(*c*) The **stomach** is a J-shaped and bag-like orga situated immediately below the diaphragm. M of the food is retained in it for 2 to $2\frac{1}{2}$ hou while it is churned up and mixed by the muscul

action of the stomach, and partly digested by the gastric juice which is faintly acid. The stomach opens into the duodenum or first part of the small bowel.

(*d*) The **small intestine** is some 22 feet in length, coiled on itself as shown in Fig. 163. It is designed to make its contents flow slowly, so that they will be well digested by its powerful digestive juices and there will be plenty of time to absorb the digested food. The first part of the small intestine is known as the **duodenum** (when this is ulcerated the condition is termed a ‘ duodenal ulcer ’), and the digestive juices from the pancreas and that of liver (bile) enter the gut here. In the lower part of the right-hand side of the abdomen, the small intestine joins with the large bowel.

(*e*) The **large intestine**, which is some 5½ feet in length, is divided into three main parts: the **caecum** with its blind off-shoot, the **appendix** (inflammation of which is termed ‘ appendicitis ’); the **colon** from which much fluid is absorbed into the system; and the back passage or **rectum** where unabsorbed and undigested food is collected in a semi-solid state for discharge as **faeces.** Normally, there is a daily evacuation of the bowel. If the faeces are allowed to accumulate, fermentation continues in the bowel and the body absorbs the poisons, so causing ill health.

(ii) The **pancreas** or abdominal sweetbread is a solid gland about 8 inches in length, which lies behind the stomach and across the front of the spine just above the level of the navel. It is the factory which produces the **pancreatic juice**. This juice enters the duodenum and is capable of digesting all classes of food — fats, meats, and sugars. It also forms an internal secretion called **insulin**, which is absorbed into the blood-stream and plays a very important part in the utilisation of sugar by the body. If this insulin secretion is

defective, **diabetes** results and the sufferer may have to have injections of insulin (see page 24).

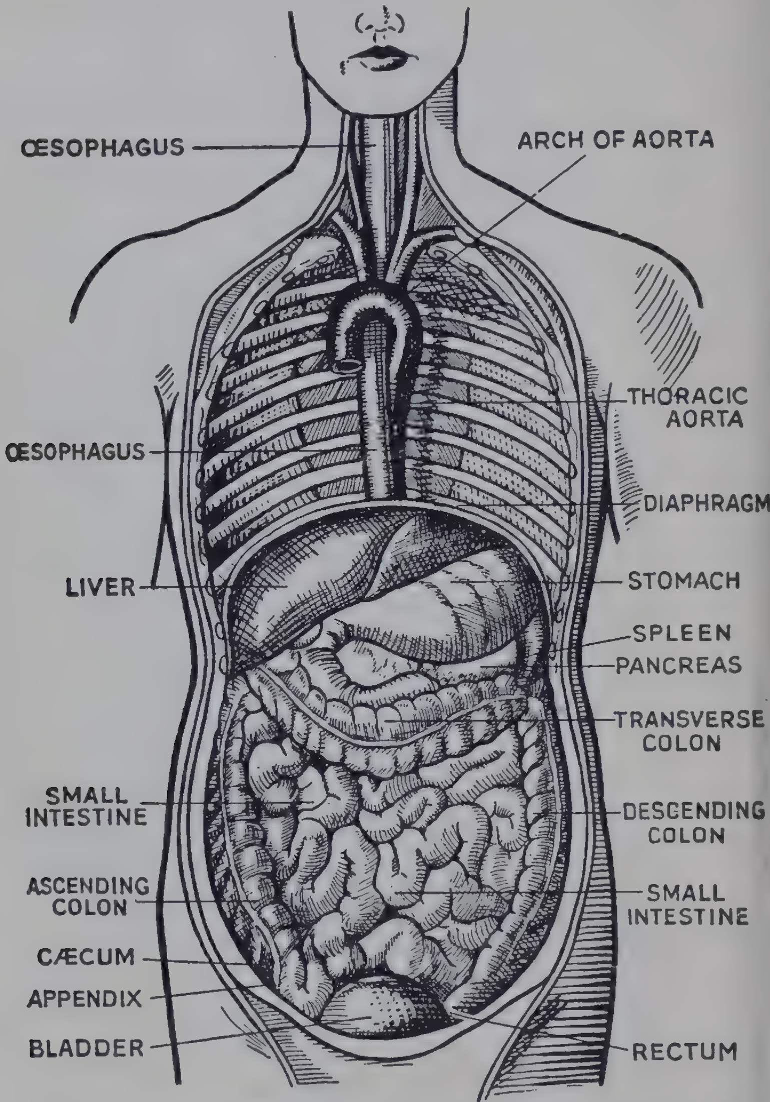


FIG. 163.—DIAGRAM OF THE CHEST AND ABDOMEN
The heart and lungs are not shown in the cavity of the chest

(iii) The **liver** is a large, solid, glandular organ. It is situated under the lower ribs on the right side of th

abdomen, just below the diaphragm. It has a very large blood-supply and, consequently, is reddish-brown in colour. If injured it bleeds very freely, causing a severe form of internal haemorrhage.

The liver has two important functions:

(*a*) **To deal with and store certain food material.** Certain elements of the food, after digestion, pass into the veins around the intestines. All these veins pass into a large blood-vessel, called the **portal vein**, which enters the liver. The liver filters the blood from this vein and takes from it certain substances: some of these, such as sugar, it stores for emergency, while other substances, which may injure the body, it excretes through the bile.

(*b*) **To form bile.** Bile is a greenish, sticky fluid which is formed in the liver and passes along the **bile-duct** into the **gall-bladder** or into the duodenum: here, it helps to neutralise the acid food from the stomach and assists in the absorption of fats. The gall-bladder is a little bag which acts as a storehouse of bile. If the bile-duct is obstructed by a gall-stone, inflammation, or a growth, the bile cannot flow into the intestine and is absorbed from the liver into the general blood circulation, so that the patient appears yellow and is said to suffer from **jaundice**.

. **Abdominal pain** is a danger signal and indicates that ›mething abnormal is happening in the abdomen. It is ften associated with a feeling of sickness **(nausea)** or actual ɔmiting. The cause may be appendicitis, gastric or uodenal ulcer, or just simple indigestion. Even the easing pain may be a sign of a serious change in the case. The rst-aider should not attempt to diagnose the condition but ıould refer the case to a doctor. It is wise not to give ny opening medicine, unless appendicitis can be excluded nd until the doctor has seen the patient. It is dangerous

to give castor oil to children suffering from acute ' bel
ache '.

3. **Vomiting** may be simple or serious, as it may be ju of a nervous nature or herald the onset of some acute fev (especially in children) or a food poisoning. Poisons i general may cause vomiting (see Chapter XXI). The may be blood in the vomit as in cases of stab-woundin ulcer or tumour of the stomach : here, the blood may l dark red and copious or like coffee grounds. This is term **haematemesis** and has been dealt with at page 55 Chapter VI on Internal Haemorrhage.

In all cases the vomited material should be inspecte and kept till the doctor has seen it. A note should be mac of the amount of vomit, the nature of any food in it, an its colour — whether it is yellow, green, dark brown or re from obvious blood.

The first aid treatment for repeated vomiting an abdominal pain is :

(i) **Lay the patient down**, and send for a doctor.
(ii) **Keep the patient warm.**
(iii) **Do not give anything to eat or drink.**
(iv) If a doctor is not available for some time and if th **vomiting** appears to be **of a simple nature**, the being no abdominal or chest wound, nor any bloo in the vomit, give the patient **sips of water** to whic **bicarbonate of soda** (baking powder) has bee added in the proportion of a teaspoonful to a tumble ful of water.

4. Swallowing of foreign bodies

Young children are apt to swallow such things as bead coins, marbles, pebbles, and safety pins, and adults ma swallow bits of bones in their food. These may lodge in o of the recesses on either side of the back of the tongue or pa into the gullet or even the windpipe.

Immediate action should be directed to remove th foreign body, as follows :

(i) **Hook a finger into the recesses at the back of the tongue**, as this is the site where many foreign bodies lodge. Should this procedure not be successful,

(ii) **Try to dislodge the obstruction by holding the child upside down** and thumping his back, or,

(iii) **In the case of an adult, thump him on the back**, while he leans well forward (see page 62 of Chapter VII).

(iv) Send for a **doctor** at once, as damage may be done to the throat or gullet by a rough object.

The foreign body may enter the stomach, and all may be well if it is smooth and not too large to pass down the bowel, otherwise an operation may be needed. The doctor will advise.

Injuries and wounds of the abdomen

These may be due to stabbing, firearm wounds, high explosives, severe blows or crushes.

(i) **Stab or bullet wounds :**

Signs :

(*a*) The presence of one or more wounds.

(*b*) Collapse (due to shock, or haemorrhage, or both).

(*c*) A portion of the intestines coming out through the wound.

The great dangers are shock and sepsis due to the protrusion of part of the intestine, or to perforation of the intestines or stomach leading to escape of their contents into the abdominal cavity, or to severe internal haemorrhage in the case of a wound of a solid organ, such as the liver or spleen (see Chapter VI, page 48).

(ii) **Severe blows or crushes**, as when anyone is run over.

Signs :

In these cases there is no wound, but there may be bruises and ribs may be broken. The injury is shown by—

(*a*) Signs of shock and haemorrhage.
(*b*) Abdominal pain.

The danger is that the liver or the spleen may crushed, resulting in severe internal haemorrhage.

(iii) **Treatment :**

(*a*) **When there is a wound with the intesti exposed** —

Lay the patient down **flat.**

Expose the injured area.

Take a large piece of cloth, towel, napk gauze dressing, or a clean handkerchief; wri it out nearly dry in warm water to which is add a pinch of salt, and place it over the wound so to **cover the intestine** and a large area of sk around.

Fix this in position with a **roller towel, ba towel**, or some improvised broad bandage, whi will pass round the body.

Raise the legs on a pillow and wrap t patient up warmly.

Do not give any food or drink by the mout

Get a **doctor quickly**.

(*b*) **When there is no wound, but probably co cealed or internal haemorrhage** —

Treat for internal haemorrhage (Chapter V page 48).

Do not give ice to suck nor anything b the mouth, as the first-aider is not in a positi to tell whether there is a tear in the intestines.

6. **Rupture (hernia)**

This means the protrusion under the skin of an intern organ, usually a portion of the intestine, through a we place in the muscles of the abdominal wall. Rupture occu most commonly in the groin, or in the upper part of t thigh, but is not infrequent at the navel. It occurs in sm babies and at any age, frequently being serious in old ag there may be more than one rupture. It may appear aft

straining while lifting heavy weights. The rupture may be small, the size of a pigeon's egg, or quite as large as one's fist.

In some persons suffering from a rupture a swelling is constantly present, although they are not necessarily ill or inconvenienced by it. However, the sudden appearance of a swelling in the groin, or the sudden enlargement of one already present, is dangerous, particularly if the patient has pain and sickness, as this may be due to the hernia becoming **strangulated**, even when a truss is worn.

First aid treatment may be sought if there is sudden pain or swelling in the region of the groin or navel.

(i) **Treatment :**

(*a*) **Send for a doctor** without delay.

(*b*) Lay the patient **down with the knees raised.**

(*c*) Apply **cold compresses** to the skin over the swelling.

(*d*) **Avoid handling the swelling**, as it is so easy to injure the intestine in a rupture, and this is very dangerous.

THE URINARY SYSTEM

1. Anatomy and function

The urinary system inside the body consists of a pair of **kidneys**, from each of which a narrow tube called the **ureter** passes to the urinary bladder; the latter discharges its urine through a tube named the **urethra**, which is short in the female and long in the male (Fig. 164).

(i) Each **kidney** is a bean-shaped organ about 4 inches in length and is situated in the loin. All the blood in the body passes in turn through the kidneys for removal of certain waste products. The kidney has the power of abstracting water and certain chemicals (*e.g.* **urea**) from the blood, the fluid thus produced being the **urine**. About 2½ pints of urine are formed daily, and this is continually being passed along the ureter to the bladder, much more during the day than at night when the body functions are slowed up.

(ii) The **ureters** are quill-like tubes about 6 inches long and convey the urine from the pelvis of their respect-ive kidney to th under side of th bladder. If a ston forms in the kidney it may be dislodge and enter the ureter If so, it causes in-tense pain or '**rena colic**'.

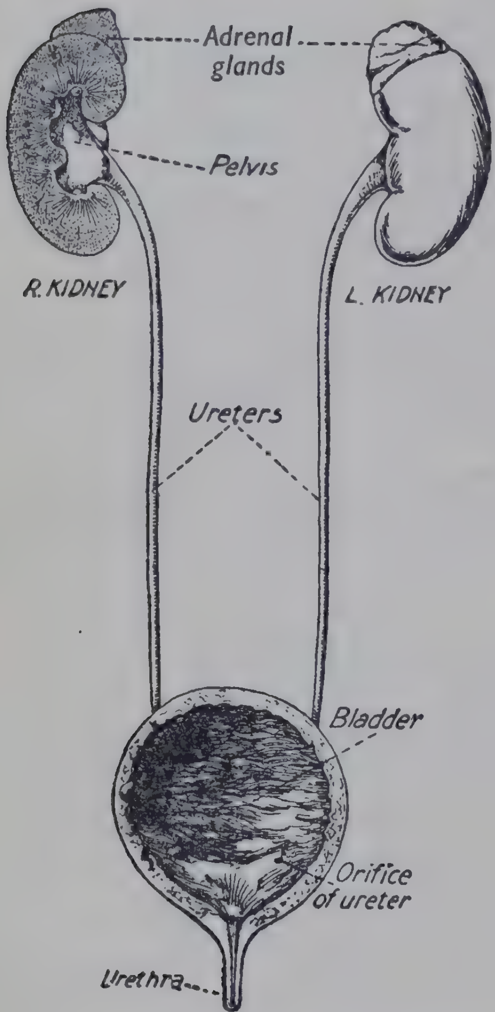


FIG. 164.—THE URINARY SYSTEM

The right kidney and bladder are shown cut through vertically

(iii) The **urinary blad-der** is a muscula organ situated i the pelvis, and de-signed to act as reservoir for th urine. It is capabl of considerable dis-tension, which is convenience. Th bladder is under th control of the will so that when it feel distended it can b emptied voluntaril at a convenien time. At its lowe and front part i opens into th urethra throug which the urine i voided from th body, usually abou $\frac{1}{2}$ pint at a time.

2. **Injuries to the kidney** may result from crushing, severe blow, or a stab or bullet wound.

(i) **Signs and symptoms :**

(*a*) Pain and swelling in the loin.

(*b*) Presence of blood in the urine **(haematuria).**

(*c*) Signs of shock and internal haemorrhage.

(ii) **Treatment :**

(*a*) Lay the patient **down.**

(*b*) Send for a **doctor**, or convey the patient on a stretcher to a hospital.

(*c*) Apply ice-bags or **cold compresses** to the site of the injury.

(*d*) **Ice** may be given to **suck**, but nothing more should be allowed.

3. **Injury to the bladder** is generally due to a crush, causing a fracture of the pelvis.

(i) **Signs and symptoms :**

(*a*) Inability to pass water.

(*b*) Blood alone may be passed, or a little water containing blood.

(ii) **Treatment :**

(*a*) Get a **doctor**, or convey patient on a **stretcher to hospital.**

(*b*) Keep the patient flat, and **wrap him up warmly.**

(*c*) Warn the **patient not to try to pass water**.

THE SPLEEN

The **spleen** is a solid organ about the size of the owner's hand, and is situated in the left side of the abdomen under the lowermost ribs. On its inner side it is in contact with the stomach. It is not concerned with digestion, but with the formation of certain white cells of the blood and the disposal of worn-out red blood-cells.

The spleen may be greatly enlarged in certain diseases (*e.g.* malaria and leukaemia), and under such conditions may rupture with even a light blow. This results in severe **internal haemorrhage** which needs immediate operation. First aid treatment consists in treating for shock and

collapse, and getting the patient transported to hospital quickly as possible.

THE UTERUS

The womb or **uterus** is a pear-shaped muscular orga lying in the centre of the pelvic cavity, between the bladd

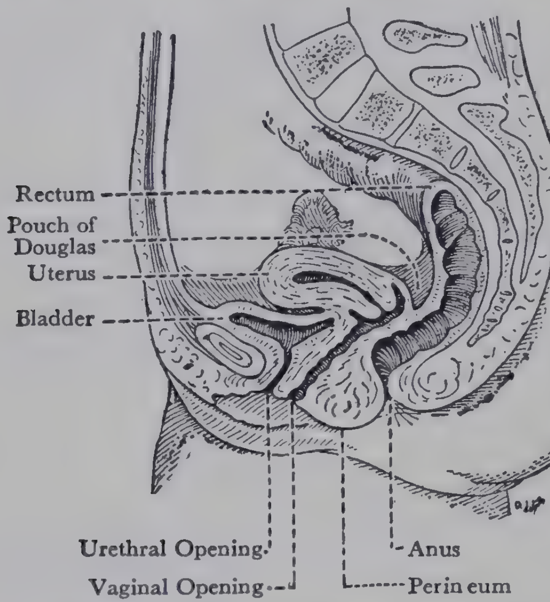


FIG. 165.—SECTION THROUGH THE LOWER ABDOMEN AND PELVIS OF A WOMAN

in front and the rectum behind (Fig. 165). As the bab develops, the uterus gradually enlarges until it occupi much of the abdomen.

The first-aider may be called to an emergency, such a severe bleeding from an abortion or a case of sudde childbirth. In **abortion,** the product of conception sep rates from its attachment to the uterus in the early month of pregnancy. Bleeding is then often profuse an dangerous. **Lay the patient down with feet raised** an **send for a doctor at once**.

Sudden childbirth is dealt with in Chapter XXII.

CHAPTER XXI

POISONING

Poisons are substances which when taken into the body are injurious to health and may, in sufficient dosage, destroy life. They may enter the body by the mouth (the route of most poisons), by inhalation (as with prussic acid and other lethal gases), or by hypodermic injection (for example, morphine).

Poisoning may occur as a result of an accident, or of criminal action as in attempted or accomplished suicide or murder. It may be suspected when symptoms of an acute illness come on suddenly in a healthy adult soon after taking food or drink, or when a person is found unconscious, burnt about the lips and mouth, or in convulsions, with a bottle containing a poisonous substance near him. Poisoning in the case of a child is less obvious, as so many illnesses of childhood are accompanied by stomach upsets. Children may swallow poisonous substances if these are not properly stored in the house, or they may eat poisonous berries, such as those of the deadly nightshade, especially in the berry-picking season. Suggestive symptoms of poisoning are sudden onset of pain in the mouth and stomach, vomiting, and cramps in the legs.

CLASSIFICATION OF POISONS

From a first aid aspect, poisons are best classified into those that burn or corrode the mouth, gullet, and stomach, and those that do not, for with the former vomiting must not be induced as it may cause perforation of the stomach, whereas in the latter group the sooner the victim vomits the better.

(1) **Burning** or **corrosive** poisons.
(2) **Non-burning** poisons.
 (i) **Irritant** poisons (act directly on gullet, stomach, and bowels).
 (ii) **Systemic** poisons (act on the nervous system through the blood-stream).
  (*a*) **Narcotics, hypnotics** or sleep-producers.
  (*b*) **Deliriants.**
  (*c*) **Convulsants.**

1. **Burning or corrosive poisons** immediately burn or corrode the tissues with which they come into contact—the lips, tongue, mouth, gullet, and stomach. There is severe pain and much swelling, which if in the throat may lead to suffocation.

Examples are **strong acids** (sulphuric acid), **alkalies** (caustic soda and ammonia), and disinfectants of the **cresol** or **phenol** type.

Treatment consists of avoiding emetics, and diluting the poison with copious draughts of water or milk, adding, if possible, two tablespoonfuls of magnesia, chalk, or whitewash to each tumblerful of water, in the case of acid poisoning, and two tablespoonfuls of vinegar or lemon, lime or orange juice to a tumblerful of water for alkali poisoning.

2. **Non-burning poisons** are of two main types:

(i) **Irritant poisons** which inflame the tissues and cause some pain, especially in the abdomen. The chief symptoms are vomiting, colic, and diarrhoea.

Examples are, metallic poisons, such as **arsenic** (weed killers and sheep-dips), perchloride of **mercury** (in hospitals and dispensaries), **phosphorus** (in rat pastes), **fungi** (toadstools), poisonous **berries** (deadly nightshade), **shellfish** in certain seasons and in susceptible persons, and **food poisoning from organisms** or their toxins.

Food poisoning has been on the increase of recent years owing to the food shortage and, consequently, the widespread use of canned foodstuffs and made-up

dishes of the meat and milk product varieties. There is usually much vomiting, accompanied or followed by severe abdominal pain and diarrhoea. In severe cases there are muscle cramps, heart failure, and maybe death. **Botulism** is the worst type of food poisoning, the death-rate being high. In this condition the nervous symptoms are marked, including double vision. The onset of symptoms may occur from an hour to two days after eating the food, depending on the amount of preformed poison and the number of germs present in the food. In food poisoning, several of those who have eaten the food suffer from symptoms at or about the same time.

Treatment consists of sending for a **doctor**, encouraging **vomiting** to get rid of as much poison as possible, giving **copious drinks of water**, tea, or milk to help replace the fluid lost from the body, and **keeping the patient warm**.

(ii) **Systemic poisons**, whether they are absorbed from the stomach and bowel, inhaled by the lungs, or injected under the skin, pass into the systemic bloodstream and act mainly on the nervous system.

(*a*) **Narcotics or hypnotics** produce drowsiness, sleep, and coma. The pupils are small, maybe pin-point, the breathing is deep and noisy, the pulse is slow, and the skin is clammy.

Examples are **morphine, opium**, and **sleeping tablets** generally.

The special features in treating patients suffering from this type of poisoning are to give a dilute solution of potassium permanganate to drink to neutralise the poison, and to keep the patient awake by rousing him as much as possible and by giving him strong black coffee to drink.

(*b*) **Deliriants** cause wild excitement, followed by delirium, drowsiness, and unconsciousness. The pupils are dilated, the pulse and breathing are rapid, and the face flushed — these symptoms are

the opposite to those seen in narcotic poisoning.

Examples are **aconite** (in some liniments **alcohol, atropine**, and **belladonna** (in some ey drops and liniments), **berry poisoning** (dead nightshade), and **chloroform**.

Treatment consists in **inducing vomitin** giving **strong coffee**, and applying **artifici respiration** if necessary.

(*c*) **Convulsants** lead to severe and repeated spasm of all muscles of the body. Spasms of the ja muscles prevent the patient from opening h mouth. Attempts to move the patient aggravat the spasms. The muscles of respiration are fixe by the spasms, so that the face soon becomes livi from oxygen deficiency.

Examples are **prussic acid** in fumigation c ships, and the **cyanides** as used in photography also **strychnine** as found in some vermin killers.

Treatment consists of inducing **vomiting** a once, keeping the **patient warm** and **in th dark**, as light aggravates spasms, and applyin **artificial respiration, and oxygen** if available.

GENERAL TREATMENT OF POISONING

The first-aider should treat all cases of poisonin promptly on general lines, unless there is clear indicatio of the exact poison taken. When the poison is known special treatment can be given as already outlined and a set out in Table on pages 252 and 253; this Table designed to facilitate easy reference for the treatment c the commoner forms of poisoning.

Send for a **doctor** and state, in writing or by telephon message, the poison if known, and the general symptom so that he can advise on the treatment or bring the require antidote.

1. In **corrosive poisoning**, that is, where lips and mout are burned, **do not give an emetic** (*i.e.* a substanc which causes vomiting).

(i) Give copious **draughts of water or milk** to dilute the poison, and if it is
 (*a*) an **acid**, add two tablespoonfuls of **milk of magnesia**, chalk, plaster, or whitewash to each tumblerful of water;
 (*b*) an **alkali**, add two tablespoonfuls of **vinegar**, or orange, lemon, or lime juice, to each tumblerful of water.

(ii) Later give **milk** or **raw eggs** beaten up in water, or olive or salad **oil** if available.

(iii) Treat for **shock**.

. In **non-corrosive poisoning**, that is all other cases, act as follows:

(i) Make the patient **vomit** at once to eliminate as much of the poison as possible. This can be done either by tickling the back of the throat with the finger or a rolled-up piece of paper, or, if patient is conscious, by giving drinks of salted water (two tablespoonfuls of common salt to each tumblerful of water) and repeating till vomiting occurs.

(ii) Lay the patient **on his side** with uppermost leg flexed at hip and knee, or face downwards with head to one side to prevent any vomit from entering the windpipe and to keep the tongue clear of the air-way.

(iii) If necessary, apply **artificial respiration**.

(iv) When conscious, give **copious draughts of water**, to dilute the poison.

(v) Later give **barley water, milk**, weak tea, or raw eggs, or flour beaten up in water, to soothe the irritated stomach and bowel.

(vi) Treat for **shock**.

(vii) If **drowsy, keep patient awake**.

(viii) Apply **covered hot-water bottle** to abdomen to ease pain.

(ix) **Preserve all vomited material and any suspected poison for examination by the doctor or police.**

THE COMMONER POISONS

Special first aid treatment to be given when the poiso
is known from the patient's statement, or from the presen
of a labelled bottle or other container.

Poison	Common Source	First Aid Treatment
Acids	Dispensaries, laboratories, garages, some industries.	Do not make the pat vomit. Give plenty of w to dilute the acid. Ad the water, if possible tablespoonfuls of ch milk of magnesia, plas or whitewash.
Aconite	In neuralgia and rheumatism liniments.	Make the patient vo Give strong tea or cof Apply artificial respirat if necessary.
Alkalies	Dispensaries, laboratories, some industries.	Do not make the pati vomit. Give plenty of w to dilute the alkali. Ad the water, if possible tablespoonfuls of vine orange, lemon, or l juice.
Arsenic	In some weed killers, rat poisons, and sheep-dips.	Make the patient vomit.
Atropine or **Belladonna**	In some liniments and eye drops also the berries of the deadly nightshade.	Make the patient vo Give strong tea or coffe
Carbon monoxide	Gas stoves or motor-engine exhaust gases.	Apply artificial respirat Give oxygen, if availabl can be obtained in s garages.
Chloral, Dial, Luminal, Medinal, and **Veronal**	In some headache and sleeping powders and tablets.	Make the patient vo Give a teaspoonful of manganate of pot crystals in a cup of wa Give hot coffee. Keep patient awake and wa Apply artificial respirat if necessary.

Poison	Common Source	First Aid Treatment
isinfectants, such ıs **Cresol, Izal,** **.ysol**, and **Phenol**	In hospitals, dispensaries, first aid cupboards, and the home.	Do not make the patient vomit. Give copious draughts of water, and a teacupful of medicinal paraffin. Add 2 tablespoonfuls of milk of magnesia, if available, to every pint of water.
ead	In some paints and hair dyes.	Make the patient vomit. Give a dessertspoonful of epsom salts in cup of water.
Iercury	Corrosive sublimate tablets or lotion.	Give white of egg in water. Then make the patient vomit.
pium (and **Morphine)**	In hospitals and dispensaries.	Make the patient vomit. Give a teaspoonful of permanganate of potash crystals in a cup of water. Give hot coffee. Keep the patient awake and warm. Apply artificial respiration, if necessary.
araffin and **Petrol**	Houses, garages, and industry.	Make the patient vomit at once. Give copious draughts of water.
hosphorus	Some rat pastes.	Make patient vomit at once. Give water or a teaspoonful of permanganate of potash in every tumblerful of water. Never give oils.
russic acid	From cyanides used in photography and electro-plating, also from the oil of bitter almonds.	Act at once. Make the patient vomit. Give artificial respiration.
trychnine	In some vermin killers.	Make the patient vomit before spasms begin. Apply artificial respiration. Keep patient quiet. Do not restrain movements.

CHAPTER XXII

MISCELLANEOUS EMERGENCIES

THERE are still outstanding a few emergencies to which the first-aider may have to attend, such as childbirth (sudden), cramps, frostbite, injuries to the external genitals, a knock-out, locked knee, stitch, toothache, and 'winding'.

1. **Childbirth.** Occasionally, a woman suddenly gives birth to a child in some public place. This is more likely to happen to a woman who has had several children. In such cases the whole process usually takes place normally, so that little help is needed beyond the following first aid treatment.

(i) **Do not move** the woman, unless it is absolutely necessary. If she must be moved, do not let her walk. Get her to lie on her back or one side, whichever is more comfortable. See that there is sufficient clothing or wraps under the mother to prevent the cold from the ground affecting her. This improvised 'bedding' should be covered with a good layer of newspapers, and if possible by a clean cloth, to prevent staining of the clothes and to deal with the birth fluids, blood, and afterbirth.

(ii) **Send for a doctor** or a midwife, summon an ambulance, and reassure the mother.

(iii) The child will gradually emerge without help, usually head first. Wipe any froth (mucus) from its mouth and nose with a clean handkerchief. Let the baby lie on its side close to the mother's thigh for warmth, and **cover it with such clothing as is available.**

(iv) **If the baby does not appear to be breathing,** gently raise it by its feet and, with the handkerchief,

clear out any mucus which may flow into its mouth; then leave lying warmly covered.

(v) The child will be attached to the mother by a white, fleshy cord, as thick as one's little finger. **Do not pull on the cord** but leave it alone until the doctor or midwife arrives. If such help is not forthcoming within half an hour, tie two tapes or pieces of string firmly round the cord, one about 5 inches and the other 6 inches away from the attachment of the cord to the baby's body. Cut the cord between the two tapes with a clean knife or pair of scissors, which should be boiled in water for 5 minutes or soaked in disinfectant and rinsed in clean water before use. Then place a dressing or clean handkerchief over the cord. **Sterility is essential in dealing with the cord, as infection of it would be a most serious matter.**

(vi) The afterbirth usually comes away without any assistance within 15 minutes of the birth of the baby. **If the afterbirth does not come away** by that time, and there is much bleeding, feel for the womb (uterus) through the skin of the lower abdomen and gently massage it to start contractions. If this does not expel the afterbirth and bleeding continues, keep firm pressure with the hand on the uterus. When the delivery of the afterbirth is complete, apply a sanitary towel to the mother, and cover her warmly.

(vii) **The afterbirth must be kept intact** with the blood-clots to show the doctor or midwife on arrival.

2. **Cramps** are sudden, involuntary, and painful contractions of voluntary muscles. They occur either from chilling, as in bathing, or when there is dehydration of the tissues following much loss of water from the body as in cholera, acute diarrhoea, and dysentery, excessive vomiting, and excessive sweating from heat as in stokers. Some people are more prone to cramps than others, especially those of the hyperthyroid type. The commonest sites of cramps

are in the muscles of the calf, great toe, thigh, and abdomen First aid treatment consists in **massaging** the affected par and applying **warmth**. In cases of dehydration, give i addition copious drinks of water containing a saltspoonfu of salt to each tumblerful of water to replace the fluid an salt lost from the body.

3. **Frostbite** is due to severe cold, especially when accom panied by strong winds, chilling exposed parts of the body such as the rims of the ears and tip of the nose, also th fingers, toes, and heels, even when they are not expose but too tightly clad or booted. Handling of bare meta greatly aggravates the condition. The cold causes spasm of the arteries supplying these parts, so the local circulatio and tissues are deficient in oxygen. The part, therefore first becomes bluish-purple as the blood in the capillaries of the skin suffers from want of oxygen. There is itching followed by acute pain. Up to this stage, the condition i akin to a **chilblain**. If treatment is not given now, the circulation in the part will practically cease as the fluid in the tissues turns to ice: the part becomes white from lack of blood, and pain disappears as the sense-organs in the skin are numbed (like they are when frozen by ethyl chloride spray for local anaesthesia). Unfortunately the victim does not recognise this danger signal, but thinks that the frostbite is disappearing as the pain goes.

Treatment consists in protecting the part from the cold blast and **very gradually warming it by slow thawing. The temperature must never be brought above tha of a cool room** — the part being left outside the bed clothes and simply wrapped in cotton-wool. Remember that the part has been frozen and massage will damage it while heat will dilate the frozen vessels so abruptly tha their walls will be damaged and the blood fluids will leak out, leading to pressure on the blood-vessels and stoppage of the circulation. Treat for **shock. Give warm drinks. Inhalation of oxygen** is beneficial.

4. **Injuries to the external genitals** in the male, as ma

occur from a blow or kick in the crutch, are extremely painful. First aid consists in **carrying** the casualty away, and applying a **pad** and bandage. A **cold compress** helps to lessen bruising and swelling. Refer the case to a **doctor**.

5. A **knock-out** in boxing is due to concussion of the brain and must be treated accordingly (see page 230).

6. **Locked knee** is a common occurrence, especially at games. A small cartilage inside the knee-joint gets temporarily out of place. Lay the casualty down with **a rolled-up coat behind his knee. Do not manipulate the leg.** Carry him off and refer him to a **doctor.**

7. **Stitch** is a painful spasm of some of the muscle fibres of the diaphragm, and occurs usually at games and in cross-country runners, especially those out of training.

To obtain relief, give a few **sips of fluid**, preferably hot, and **gently rub** the affected side.

8. **Toothache** may be treated in the absence of a dentist by applying **oil of cloves** to the affected tooth and the surrounding gum, and the giving of two tablets of **aspirin.** Send the case to a **dentist** as soon as possible.

9. **Winding** is due to a blow in the pit of the stomach as may occur in boxing and at football. The blow upsets the solar plexus, which is one of the main sympathetic nerve centres lying in front of the spinal column just behind the stomach (see page 226). This leads to a sudden pooling of blood in the large blood-vessels of the body, so the head and brain are deficient in blood, causing a faint or collapse. Treat by drawing the casualty's **knees up** and **gently massaging his abdomen**. He will soon recover, but make him **lie down** for a bit to allow the circulation to adjust itself.

CHAPTER XXIII

ACTION AT THE INCIDENT

SHOCK is the chief cause of death in accidents, and it is made much worse not only by inefficiency and rough handling, but also by over-zealous attention. It is of the utmost importance, therefore, that the first-aider should approach a casualty in a proper manner, first making a quick appreciation of the circumstances of the case, then a simple and painless examination, followed by the minimum of first aid measures necessary to save life and prevent the condition worsening.

1. Appreciation of the incident

(i) Immediately, **note anything dangerous** in the surroundings and take steps to prevent or counter it; for instance, the hazard of a pool of petrol under an upturned motor-car would call for anti-fire precautions, while the presence of an exposed live electric wire would necessitate precautionary measures to be taken by the rescuers.

(ii) Then, quickly **assess the seriousness of each case** and **decide on priority of treatment**, as the most urgent conditions must be dealt with first, such as severe haemorrhage or stoppage of breathing.

2. Immediate action

(i) Get **bystanders or passers-by to help**, as follows:

(*a*) One person should be detailed to **send a message** by the quickest means (*e.g.* telephone or motor-vehicle) **to the doctor**, stating briefly the place of the accident, the types of casualties, and any special conditions. If possible, write the message

for despatch to lessen the risk of its becoming garbled. The same messenger should **summon an ambulance** and **inform the police**, in appropriate cases.

(*b*) A second person should be sent to **fetch necessary materials** from the nearest house or factory — for example, bandages, blankets, hot-water bottles, tea, improvised stretchers, etc.

(*c*) Other persons should be instructed how to **help with the casualties**; and

(*d*) Others, if necessary, should be told to hold up or guide **passing traffic**, should the accident be on the road — for example, to stop traffic when there is the danger of petrol taking fire, or to convey a messenger to a doctor or nurse, or to transport minor casualties to hospital.

(ii) **Examine each casualty** quietly, tactfully, and sympathetically to ascertain the injuries which require attention. Enquire how the accident occurred and what symptoms are present. Handle the patient as little as possible to avoid causing pain and shock. Make a quick, general assessment of the condition by noting:

(*a*) The **colour of the face**; whether it is pale or congested.

(*b*) Whether the person is **conscious or not**.

(*c*) Any **visible bleeding**, including the ears, nose, and mouth, as in fracture of the base of the skull.

(*d*) **Unnatural position** of the limbs, as in fractures or dislocations.

(*e*) **Limpness of one limb** compared with another, suggestive of paralysis.

(*f*) **Type of pain**: whether it is localised to a particular spot: if over a bone, it is suggestive of a fracture; if over the abdomen or chest, it may indicate internal injury.

(*g*) The **pulse-rate**, which is increased in shock and slow in bad head injuries.

(*h*) The **rate and type of breathing**, which is rapid and shallow in shock, but deep, laboured, and noisy in severe head injuries.

(*i*) Any **dampening of clothing** due to bleeding from covered parts.

(*j*) Any **rigidity of abdomen** in the mid-line of body just below the ribs. Rigidity here is suggestive of internal abdominal injury.

(*k*) In cases of **poisoning**, whether there is any **burning of lips and mouth.**

(*l*) In cases of **unconsciousness**, whether there is any distinctive **odour from the breath**. For example, the smell of sweet almonds in prussic acid poisoning, or that of new-mown hay in diabetic coma, or a urine-like odour in cases of uraemia. If there is a smell of **alcohol**, do not jump to the conclusion that it is a case of drunkenness: the alcohol may have been taken after the injury, and even if taken before, it may have been for some illness. Moreover, a drunken man may fall and fracture his skull.

(iii) Give the **minimum first aid necessary**, remembering the golden rules on page xix. **Keep the rest of the body covered**, not forgetting the importance of protecting the under side of the patient, while any part is being exposed for treatment. **Ensure a clear air-way** by placing the patient's head in proper position. Improvise bandages, splints, etc., as required. All casualties should be **labelled** (see pages 261 and 262).

(iv) **Do not move or transport a casualty until he has recovered from primary shock and any fractures have been immobilised**, unless such action is necessary to prevent the condition worsening, as in cases of submersion in water, exposure to fire, or contact with an electric current. When fit to be moved, the patient should be well wrapped and transported directly from the scene of the accident to his

home or hospital by comfortable and efficient means, without any jolting. Every time a patient is moved, there is an added risk of inducing secondary shock. Ambulances should be driven slowly and, above all, smoothly. The first-aider should accompany the patient to the doctor or to the hospital, so that he can look after him on the way and be available to give full information to the doctor.

It is not intended to discuss methods of transportation here, as these are dealt with fully in the *British Red Cross Society's Administration Manual.*

3. Labelling of casualties

Whether under peace or war conditions, it is most desirable that all casualties should be labelled, as this facilitates disposal and helps to ensure prompt and correct treatment on arrival at hospital, and is a safeguard against over-dosage of drugs, such as morphine, being given, or the presence of a tourniquet being overlooked.

Writing on the label should be clear, the name being in block capitals. Brief particulars of the nature of the injury and treatment should be included. Special forms of treatment given should be indicated both on the label attached to the clothing of the casualty and marked on his forehead with indelible pencil, if possible.

The special markings used are as follows:

X Requires **priority of transportation and treatment** on arrival at the hospital. Burns, internal and crush injuries, and unconscious states belong to this category.

H There has been **severe haemorrhage**.

T A **tourniquet** has been used. The label should contain entries of the times of application and release of the tourniquet.

M **Morphine** has been given. Dosage and time of administration should be recorded.

Under war conditions, these additional markin
are used :

C Contaminated by a **persistent gas** (mustard ga
lewisite).

XX Case of **non-persistent gas** poisoning (phosgen
chlorine, arsenicals).

P Burned by **phosphorus**.

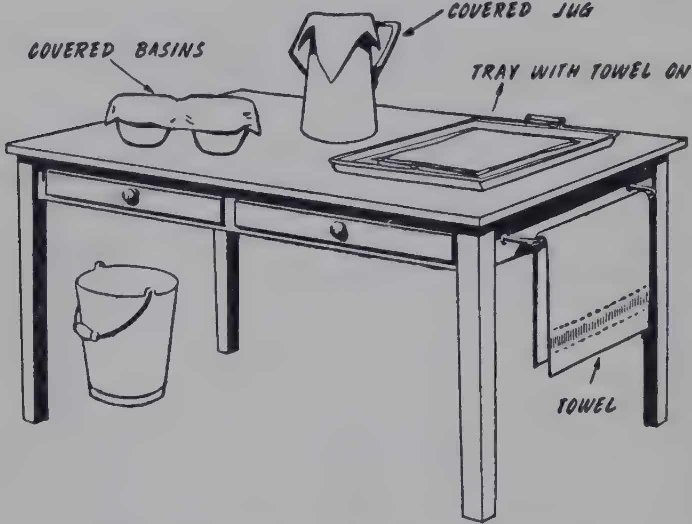


FIG. 166.—PREPARING FOR THE DOCTOR

4. **Preparations for the doctor** (Fig. 166)

If it is necessary to make preparations for the docto
either at a first aid post or in a house, act as follows :

(i) **Boil plenty of water** and allow it to cool in kettle
covered saucepans, or covered enamel jugs, and hav
cooled, boiled water and actual boiling water ready.

(ii) Clean a strong, **plain table** and wipe it over wit
disinfectant before placing articles on it.

(iii) Wash a couple of **enamel basins**, rinse the
thoroughly with boiling water, and cover them wi
a clean towel.

(iv) Put out a **clean tray** (preferably enamel) which has been wiped over with a disinfectant, and cover it with a clean, newly-ironed towel. The doctor may wish to lay his instruments and dressings on it.

(v) Put out **disinfectant, soap, nail-brush, and clean towels** for cleansing of hands, and **safety pins** and **scissors** for use with dressings.

(vi) Place a **pail for dirty dressings** under the table.

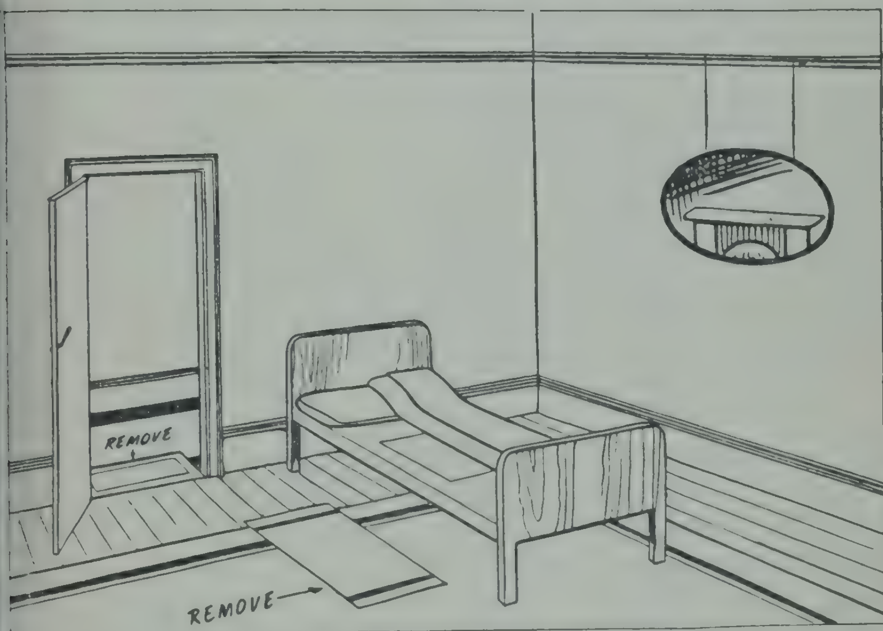


FIG. 167.—PREPARING A ROOM FOR A CASUALTY

5. Preparing for the patient at home

In certain circumstances, particularly in outlying places where neither doctor nor nurse is available locally, it may be necessary to accommodate the casualty in the home. In this connection, it must be remembered that a very high proportion of casualties in this country actually occur in the home. It is advisable, therefore, for the first-aider to have some knowledge of how to prepare the room and bed to receive a casualty (Fig. 167).

(i) **Choose a bright, airy room** with a pleasant outlook. A **downstairs** room is preferable, as this is easier to approach with a stretcher and those in the home can more readily keep an eye on the patient.

(ii) **Remove all unnecessary furniture** to make room and lessen the harbouring of dust, which is a potential source of infection. Mats and rugs in the passage and room should be removed, as these are apt to cause slipping.

(iii) **Light a fire** to warm the room as a safeguard against shock. The fire also helps to ventilate the room and is desirable except in hot weather.

(iv) Use a **narrow bed** and place it so that there is ample access to both sides to attend the patient.

(v) **Prepare the bed** by placing **boards** across its framework, under the mattress, to prevent sagging in the case of a fracture of legs, pelvis, or spine. Put a **mackintosh sheet or drawsheet** over the undersheet, where the hips will come, to lessen the risk of soiling. When the bed-pan or urine bottle is to be used, cover the drawsheet with a newspaper or sheet of brown paper, as a further precaution. Warm the bed with **hot-water bottles** which are **well covered.** The **blankets** should be as light as possible, and the beclothes should be folded back lengthwise to receive the patient.

(vi) **To put the patient to bed**, first place the stretcher on the bed near one side, the injured side of the patient being towards the centre of the bed. Three people should stand on the stretcher side to lift the patient and one on the other side to remove the stretcher.

(*a*) The first of the lifters should place one arm well under the patient's shoulders and the other arm round the chest in front.

(*b*) The second lifter should pass his left arm under the patient's buttocks and his right arm should be passed over the hips, so that he can grasp the

patient's clothing as far under the buttocks as possible.

(*c*) The third lifter should pass one arm under the knees and the other under the ankles of the patient.

On the word 'lift', the second lifter should roll the patient towards him by the grip he has at the buttocks, while the other two lifters straighten their

FIG. 168.—PREPARING A BED FOR A CASUALTY

backs. The helper on the far side then should remove the stretcher, and the patient should be gently lowered on to the bed. The blankets should now be turned over the patient, a cradle (improvised) being placed over the injured part, if necessary, to take the weight of the clothes and to help to protect the part from unintentional knocks. An arm injury should be supported on a cushion or pillow. If the patient is unconscious, turn him on to his uninjured side with uppermost leg flexed at hip and knee, if possible: such a patient must not be left as there is a danger of the air-way becoming blocked by the tongue falling back. See that **any hot-water bottles are covered and separated from the patient by a layer of**

blankets. Arrange the pillows to give the greate comfort to the patient (Fig. 168).

Details of the care of the patient in the home belon to the province of home nursing, and are given in th *British Red Cross Society's Nursing Manual No. 2.*

CHAPTER XXIV

CIVIL DEFENCE FIRST AID

HE principles of first aid are the same whether in peace war. The main difference is in their application; for stance, during air-raids many public services are more less at a standstill and hospitals are overwhelmed with rk, so that those at the incident and at first aid posts ve to be more self-reliant and take more responsibility an at incidents in peacetime. It is encumbent on them, erefore, to make themselves more and more proficient in actical first aid.

The majority of casualties among civilians during war sult from aerial bombardment, whether this be by mbing from piloted aircraft, with incendiary, high plosive, or atomic bombs, by explosion of pilotless air-aft (V1), by long-range rockets (V2), or as a result of issiles and fragments from anti-aircraft fire. Wounds and uries are frequently multiple and may be of any type, luding atomic radiations, blast effects, burns, com-ession or crush injuries, fractures, gross bruising, and ised, lacerated, and punctured wounds. The type and ent of injury also depends on the weight of the missile, distance the casualty was from the point of detonation, ether he was under cover or not, and the type of structure ing the cover.

The subject of **air-raid burns** has been dealt with at ges 141 to 145 of Chapter XIII.

In the case of **biological warfare**, nothing can be done the first-aider other than to take general personal ecautions to avoid being infected, whether the intention to transmit this either by inhalation, ingestion, or

through wounds of the skin. There will be no evidence infection at the incident, and the disease will not apparent until after an incubation period of a day or mor Personal precautions against germ infection include th wearing of protective clothing and respirators, disinfectio of clothing and exposed skin after an attack should th type of warfare be practised, and thorough cleansing of th hands at all times before partaking of food.

The following appreciation of Civil Defence First Aid ha been written in conjunction with that in *A.R.P. Handboo No. 10*, 'First Aid in War for Civil Defence Purposes'.

This account deals mainly with serious injuries an therefore, gives an incomplete picture of casualties as m with under actual air-raid conditions. Slight contusion sprains, minor burns, minor lacerations and cuts, whic only require treatment at first aid posts, will also occur. I fact, from past records, it is estimated that out of ever 100 casualties, 23·5 will be killed, 28·5 seriously injured an will need admission to hospital, and 48 will be slightl injured and could, therefore, be dealt with at first aid post

In raids by day the number of persons injured is likel to be higher than in night raids, because more people ar in the open and so are less likely to be protected than a night when they will be in their homes. With piloted ai craft the kind of attack by day differs from that by nigh During air-raids by day, flying fragments of bombs, splinte of glass, and other pieces of debris are responsible for large number of injuries, such as lacerated and penetrati wounds. By night, falling debris from the demolition partial destruction of buildings will be likely to cau suffocation (asphyxia) by burying people; but compressio injuries, gross contusions, and fractures will also be commo With a type of bomb which is designed for a maximu superficial blast effect (such as was the flying bomb V there is little or no fragmentation such as occurs with thic cased H.E. bombs; if it produces a crater at all, it is usual small. Apart from a direct hit by such a missile, which w demolish an ordinary stone or brick building, blast m

amage other buildings at a considerable distance and over widespread area, with comparable results to those pro- iced by H.E. bombs or parachute mines. One of the rincipal causes of casualties, especially when people are ught in the street or in shops, arises from pieces of broken ass blown in all directions. People who take refuge in elters will frequently escape such injury, although cases temporary or permanent deafness may result from the ast itself. As is to be expected, eye injuries bulk largely nongst those due to flying fragments of broken glass and her materials; gross injuries will also be caused by flying asses of debris, rubble, stones, bricks, and when people e thrown violently against hard substances. Injuries can e classified as:

Lacerated and contused wounds

These are common and may be extremely severe, with rious damage to the trunk and internal organs; limbs e frequently completely torn off. Wounds may be less enly destructive but associated with severe crushing of uscular and other tissues; or there may be multiple juries. Such injuries may be primary, that is, due to rect impact of flying debris, or secondary, when a person blown against some hard, jagged, or rough object. There ay be little bleeding at first with those injuries because the accompanying shock. The wounds are nearly always vered with dirt and dust, and fragments of metal or othing; all kinds of debris may be embedded in them. cerated wounds received in the open are almost twice as mmon as those inflicted in houses.

Punctured wounds

The majority of fragments from H.E. bombs are tremely small but travel with very high velocity. The ounds they cause on the skin are often insignificant but e damage to the tissues beneath is frequently very tensive. The brain and other organs may be severely jured. The skin may be peppered with minute wounds om fragments of glass, of brick, stone, metal, or wood,

and such wounds are sometimes difficult to distinguish fro those caused by small fragments of H.E. bombs. Multip punctured wounds may occur from flying splinters of gla and secondary missiles.

Shock may be severe with punctured wounds but t main danger is from haemorrhage, especially intern bleeding, and it may be sufficient to cause death within short time.

3. **Penetrating wounds**

These are almost twice as common amongst casualti in the open as compared with those in dwelling house Gross lacerations and penetrating wounds are frequent inflicted by massive bomb splinters. They are most ofte found in casualties which occur close to the explosio of a bomb, without any intervening structure as a pr tection.

Penetrating wounds may be caused by splinters of bomb by fragments of shells, by pieces of broken glass, by flyir stones, rubble and the like, or by machine-gun and rif bullets. If the missile is retained in the body it constitut a ' penetrating ' wound; if it passes right through the boc a ' perforating ' wound results. In the case of a perforatir wound the entrance wound may be of small size, and th exit wound frequently much larger, especially if the missi has struck a bone in its passage through the body. this is the case there is some likelihood of the entranc wound being overlooked and, with attention concentrat on the exit wound, the seriousness of the damage caused b the passage of the missile may not be appreciated. In th case of penetrating wounds also, the underlying dama may be much more extensive than the size of the wour suggests.

Penetrating wounds of the chest-wall and abdomen ma prove rapidly fatal from severe injury to a vital organ from internal haemorrhage.

An ' open pneumothorax ' (which means the entry air into the chest cavity from without, through a wour

ausing collapse of the lung on that side by pressure of ne air) is an example of a serious injury to the chest. This nay produce what is known as a 'sucking wound', in hich condition air and blood pass in and out of the wound s the patient breathes. With injuries of the chest and bdomen, apart from the danger of haemorrhage, shock f some degree is always present and may be so extreme as constitute a grave menace to life. In both day and night aids splinters play a large part in causing fatal chest njuries; compression injuries of the chest also account for uite an appreciable number. Fractures of the ribs are ound in a large proportion of chest injuries, and are often ssociated with severe lacerations and penetrating wounds f the chest-wall. During both day and night raids, the bdomen is exposed to gross injuries from bomb splinters nd pieces of flying debris; many of these, like the exten-ve penetrating wounds, are fatal.

. Burns

Burns may be caused by incendiary bombs, but more equently result from the secondary effects of H.E. bombs hich overturn hot stoves or throw about oil or pieces of urning coal, or short-circuit live electric wires, thus setting re to inflammable articles; hot bomb splinters sometimes nite bedding.

During night raids some fatal casualties will be due to ctensive burns which cause death from shock. Trapped sualties who are burned by lighted or smouldering debris, ten have other serious injuries, and in fatal cases these obably are largely responsible for death. In day raids the open, burns are not common, but severe and tensive burning of the face, head, and chest may occur hen, for example, a petrol bus is set on fire by a bomb cplosion. During what is termed 'saturation' or cascade' raiding, in which many thousands of incendiary nd H.E. bombs are dropped within a very short space of me upon a given area, there will be a great preponderance f severe and fatal burns. In the last war the flying bomb

and the long-range rocket caused few fires directly, althoug
secondary fires occurred under the conditions mentione
above.

5. Compression injury and suffocation (asphyxia)

These form a substantial proportion of casualties an are a common cause of death. In many cases where person are crushed beneath debris, there is gross damage to th head or chest of fatal severity. It is sometimes difficult t decide whether the cause of death is such an injury o suffocation.

More compression injuries occur during night raids tha in day raids for the reasons already given. During da raids those who sustain compression injuries, or who ar suffocated, are people sheltering under the walls or porche of houses, or in shelters which receive a direct hit. Fractures open and closed, especially of the bones of the skull, of th ribs, and of the limbs, are met with among people crushe under girders, masonry, beams, or other debris; fracture of the spine are less frequent. Less dangerous injuries, suc as severe contusions, of course, occur too. Compressio injuries may give rise to serious complications and requir extremely careful treatment if life is to be saved.

Some of these casualties, when extricated, show littl external sign of injury and may complain of nothing mor than numbness and stiffness of the muscles in the crushe part, even though this has been subjected to considerabl pressure. Their general condition may appear quite goo both during the time they are trapped and after they ar freed. Many recover completely after appropriate trea ment and rest in hospital. In some cases, however, shoc develops within a few hours. With adequate transfusio all but the most severe cases survive. In some of thes patients, after recovery from shock, the kidneys becom unable to excrete urine, and if this inability is not overcom within 6 to 8 days, the patient will die because of th accumulation of waste products in the body. Such cas are said to have developed what is known as ' crus

yndrome' (' syndrome' being the term applied to a group f symptoms occurring together regularly and constituting disease or condition to which a particular name is given). t should be emphasised that this syndrome only occurs hen the blood-supply of muscle has been cut off for such time that the muscle dies. This happens more frequently the limb muscles, since they are less protected than those f the body. Certain substances derived from the dead uscle poison the kidneys, but only, it is stated, if the urine acid. For this reason, alkaline drinks should be given at e earliest opportunity to ensure that the harmful subances are washed out rapidly by an alkaline urine in hich they can do no harm. This damage to the kidneys done soon after release, but does not become evident ntil the lapse of many hours, by which time the patient ould be in hospital. It is much easier to prevent the idney damage than to cure it; prevention, therefore, is f the greatest importance, and the earlier steps are taken make the urine alkaline the better. This should be one for all persons who have been trapped by debris for ne hour or more, as they may possibly develop crush ndrome, whatever their apparent condition at the time f release. They must all be treated as severe casualties in hom early action may avert a serious outcome.

i) **Action to be taken on encountering casualties trapped beneath heavy debris:**

(*a*) If there is a **doctor at the incident**, notify him immediately a trapped casualty is located. He may be able to give valuable treatment while the victim is being released, and to make special arrangements for his disposal after release.

(*b*) **If no doctor is immediately available**, report the presence of trapped casualties to the local Control or Report Centre, through the Officer-in-Charge of the incident. The Medical Officer (or his representative) in the Control Centre will then endeavour to send a doctor to the incident and will put into operation any local arrangements which

have been made for the treatment of this type case.

(ii) **Treatment of crush casualties at the inciden** Pending the arrival of a doctor, apply the followi treatment, **if only a limb or limbs are involved**

(*a*) Give **plenty of liquid**, up to four pints by t mouth, if there are no signs of any abdomin injury. For the reasons given above, this shou be administered before the pressure is relieve **but in no case must this delay extrication**. you can get baking soda (bicarbonate of soda dissolve two level teaspoonfuls in a pint of co water and let the patient drink as much of this he can. Follow this with drinks of hot sweet t or coffee. Tea or coffee, other mild alkali (magnesia, alkali powder for indigestion, etc.), even plain water, should be given if baking soc is not available. **Never give washing soda ; is poisonous.** In the case of a casualty who trapped in a position difficult to reach, the use an india-rubber feeding-tube is sometimes nece sary. It may be difficult to prevent liquid delivere into the mouth under pressure from entering th air-passages and flooding the lungs. It is dangerou therefore, to administer it through a tube from height. Unless the position of the casualty allov him to control the flow of fluid, none should given until the arrival of a doctor, even though little time may elapse before he arrives.

(*b*) Give the usual **treatment for shock**. It advisable that a limb which has been compress should be raised, should **remain uncovered**, a not have hot-water bottles placed near it. One the reasons is that the application of heat aft release causes a sudden rush of blood, with increas swelling in the numbed and damaged limb, and consequent reduction of circulating blood-volu in the body. This increases shock. The circul

tion should be allowed to return to normal gradually.

(*c*) **Attach a label to the casualty** and mark it with a bold **X**. On the reverse of the label give the following particulars:

Crushing Injury

Limb compressed for........(insert period if known)
Limb released at............(time)
Baking soda or other alkali given....teaspoonfuls
Total amount of fluid given before release....pints

All these cases must be **despatched to hospital** by ambulance, and the ambulance attendant must be given full information about the injury and instructed to notify the hospital authorities immediately on arrival.

Injuries from atmospheric blast

Injuries from atmospheric blast alone were rare during e Battle of Britain, but in the bombardment of Malta ey were common, because of the weight of the attack ıd of the structure of the shelters, which were largely bterranean and deep in rock. With the introduction of :w explosives and heavier air attacks on this country such uries became more common.

There is a marked variation of individual symptoms, d of their intensity, which depends upon the distance the sualty is from the explosion, the size and quality of the plosive charge, and nature of protection. Cumulative perience of the effects of atmospheric blast on a person, ıo is not at once killed by it, has enabled a clear picture these effects to be formed.

Certain signs and symptoms are constant and may be served by the first-aider at the incident.

These are shock, which comes on immediately and is vays profound in severe exposure, and restlessness, which pronounced in such cases and present in most. There is ense of fatigue which affects the will as well as the muscles,

and sometimes there is an inability to stand.

The first or positive pressure wave, which is always up on the detonation of an explosion, very soon loses velocity and force, 1500 to 2000 feet per second, but strikes a near-by body (within 30 feet) with the impact a strength of a severe blow which affects principally t internal organs on that side of the body which faces t explosion. It may cause bleeding in these organs, especia in the lung of that side.

(i) **Signs and symptoms of blast injury.** The fi signs of this lung injury are usually not seen until hour or two after the exposure, when a dry cou with difficulty in breathing is accompanied by pa in the chest, a pain which is increased by the coughir Cyanosis also becomes evident at this time.

The coughing-up of blood, or of sputum tinged wi blood, soon occurs, for in these cases there is bleedi into the tissues of the lungs.

Pain in the abdomen is uncommon; when it do occur it is usually associated with injury to one other of the abdominal contents.

Pain in the ears is not infrequent and may indica rupture of the ear-drums, though this may occ without any symptoms at the time. Later, partial complete deafness frequently follows, otherwise the is singularly little effect on the skull or its contents.

(ii) **Treatment of blast injuries.** The first essential the handling of these casualties at the incident is treat the profound shock from which they all suff Wrap the person warmly in blankets, apply hot-wa bottles, place him on a stretcher, and send him as stretcher case in an ambulance to a hospital as so as possible.

No attempt must be made to carry out a form of artificial respiration.

Morphine should be avoided except in cases wh there is great restlessness, when $\frac{1}{3}$ to $\frac{1}{4}$ grain may given by a doctor.

For the pain in the chest, increased by the bouts of coughing, a broad-fold triangular bandage round the chest over the clothing will give some relief. When there are no signs of injury to abdominal organs, hot sweet tea may be given. **Cigarettes must not be given or allowed.**

Label the person with an **X**, and inform the ambulance attendant of the nature of the case, so that he may keep the patient fully recumbent on the way to hospital, and pass on the information on arrival there.

. Abdominal injury

The most common form of injury to the belly as a result f an air-raid is a penetrating wound of the abdominal wall, hich may or may not have extended through all its proective layers of skin, muscle, and fat and opened up the bdominal cavity itself. A frequent cause of this injury s a piece of metal from any type of H.E. bomb, or it may e due to fragments of glass, stones, or rubble blown hrough the air by blast from an exploding H.E. bomb, lying bomb, or long-range rocket. Although a penetrating ound of the abdomen is most frequently found on its ront or side walls, it must be remembered that a wound which involves the interior of the belly may be caused by agments of metal, etc., which may have entered it through e buttock, chest-wall, or back, especially when a person as been lying or crouching down when hit. First-aiders ust always bear this in mind when they suspect an internal bdominal injury, and no external wound is visible on the ont of the body to account for this; otherwise they may iss the actual entrance wound elsewhere. Wounds of the elly also occur from machine-gun or rifle bullets but these re generally perforating, with an entrance and exit wound.

Any wound of the abdomen must be regarded as xtremely serious, on account of the important organs ontained within it, and may prove fatal within a short pace of time.

The chief dangers and immediate cause of death are

internal haemorrhage and shock. Any wound of the bell which causes protrusion of the bowel is accompanied b severe shock.

(i) **First aid treatment for abdominal injuries:**

No time must be lost in sending a patient wit an abdominal injury to hospital. A first-aide cannot hope to check internal haemorrhage, and shoul not waste time in trying to do so. He can, howeve do something to minimise the shock from which th patient is suffering.

(*a*) Lay the patient down on his back on a folde blanket or blanketed stretcher with his knees draw up and supported on a rolled-up blanket place beneath them. Support his head and shoulder on pillows or rolled-up blankets. This **positio relaxes the abdominal muscles** and may pre vent more bowel from coming out, if any ha protruded. Place a protected hot-water bottle a his feet, between his thighs, and on each side o his chest — do not place a hot-water bottle near th wound. Wrap him in blankets, leaving a space fo the wound to be dressed.

(*b*) **Dress the external wound.** If intestines protrud from the wound do not attempt to touch or replac them but cover them at once with a large piece o dry sterile gauze or lint (with the smooth surfac downwards), with a large pad of cotton-wool o top, and bandage firmly but not too tightly with broad-fold triangular bandage. A large first aid c mines dressing is useful but should be covered wit a broad-fold triangular bandage over the rolle bandage as an extra support. Cover the abdome with a blanket.

(*c*) If there is no protrusion of the bowel, treat th patient as above, whether the wound is horizont or vertical. **Cover the abdomen with a blank**

(*d*) **Do not give anything by the mouth.**

(*e*) **Do not move the patient unnecessarily** un

he is ready to be placed in the ambulance. Remembering that every movement increases shock, move him with the utmost care and gentleness.

(*f*) **Call a doctor** to see the case, if one is available.

(*g*) **Label the patient** and mark an **X** on the label. Draw the attention of the ambulance attendant to the urgency of the case, so that the matter will be brought to the notice of the hospital authorities on arrival there.

APPENDIX A

CONTENTS OF FIRST AID HAVERSACK

Adhesive plaster, 1 inch, 10 yards spool
Adhesive wound dressings, $1\frac{1}{2}$ inches in diameter
Bandages, roller, 3 inches by 6 yards
Bandages, triangular, 38 inches
Bowls, enamel, 8 inches and 6 inches (one of each)
Brush, camel hair
Cotton-wool, white absorbent, 4 oz. packet
Dressings, first field
Dressings, shell
Euflavine tablets (2 bottles of 25)
Forceps, dissecting
Gauze, plain white, 6 yards in packet
Grey wool, splint, 4 oz. packet
Jaconet (yard)
Lint, white, 6 oz. packet
Sal volatile, in screw-top bottle, 2 oz.
Scissors, dressing, 5 inches, blunt
Splints, set of 6 with metal connections (four 11 inches long, two 9 inches long)
Torch, electric, 5 inches, with spare battery
Tumbler, medicine glass, graduated, 2 oz. in leather case
Tumbler, plastic

APPENDIX B

CONTENTS OF THE FIRST AID CUPBOARD IN THE FACTORY OR HOME

	Amounts for home *
dhesive plaster, 1 inch wide	1 spool
dhesive wound dressings, $1\frac{1}{2}$ inches in diameter	12
ntiseptic (euflavine tablets, 25)	1 bottle
spirin	1 bottle
andages, 1 inch wide	2 rolls
andages, 2 inches wide	2 rolls
andages, 3 inches wide	2 rolls
andages, triangular	4
icarbonate of soda, 4 oz.	1 tin
owls, enamel, 6 inch diameter	2
rush, camel hair	1
rush, nail	1
astor oil, 4 oz. in a drop-bottle	1 bottle
old cream, 2 oz.	1 pot
ollodion (for small wounds and bites)	1 tube
otton-wool, $\frac{1}{2}$ lb.	1 packet
ressings, first field type	3
rceps or **tweezers**	1 pair
auze, 6 yards	1 roll
nt, white, 4 oz.	1 roll
edicine glass, graduated 2 oz.	1
ethylated spirits, 8 oz.	1 bottle
ilk of magnesia, 4 oz.	1 bottle
otebook	1
ncil	1

* The quantities for a factory will depend on its size and nature of work done. In ctories, **special eye drops** are used, as follows: cocaine, 0·5 per cent; perchloride mercury in castor oil, 1 in 3000.

	Amounts for ho
Potassium permanganate crystals, 4 oz.	1 pot
Safety pins, rust-proof	1 box
Sal volatile, in screw-top bottle, 2 oz.	1 bottle
Salt, common, 4 oz.	1 tin or p
Scissors, dressing, 5 inches	1 pair
Soap	1 cake
Torch, electric	1
Tumbler	1
Vaseline, 4 oz.	1 pot
Vinegar, 2 oz.	1 bottle

APPENDIX C

THOMAS'S SPLINT

Thomas's splint was originally designed for fractures of the thigh-bone.

(i) **Uses:** It may be used under medical guidance for all fractures of the thigh-bone, except where there is a wound in the upper part of the thigh, groin, or buttock, against which the splint will press; all fractures about the knee-joint and upper part of the bones of the leg; and certain extensive flesh wounds of the thigh or leg.

It is seldom used in ordinary first aid or by the Civil Defence Casualty Services at incidents, and then only under the following conditions:

(*a*) When a casualty has to be taken **a long distance to hospital**.

(*b*) When a casualty has to be carried some distance **over rough ground**.

(*c*) When it is not possible to send a casualty direct to hospital at once and he may require to be **detained at a first aid post or point**.

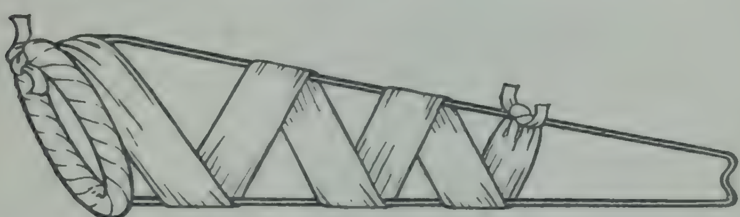


FIG. 169.—THOMAS'S SPLINT WITH BANDAGE LOOPED OVER SIDE IRONS TO MAKE A TROUGH

(ii) **Construction** (Fig. 169): It consists of a large metal ring, padded and generally covered with leather, which lies obliquely so as to fit over and conform to the shape of the thigh at the groin. Attached to each side of the ring are two long, round iron bars of $\frac{3}{8}$-inch gauge, which pass down on either side of a limb converging towards one another as the limb narrows, and terminate at the

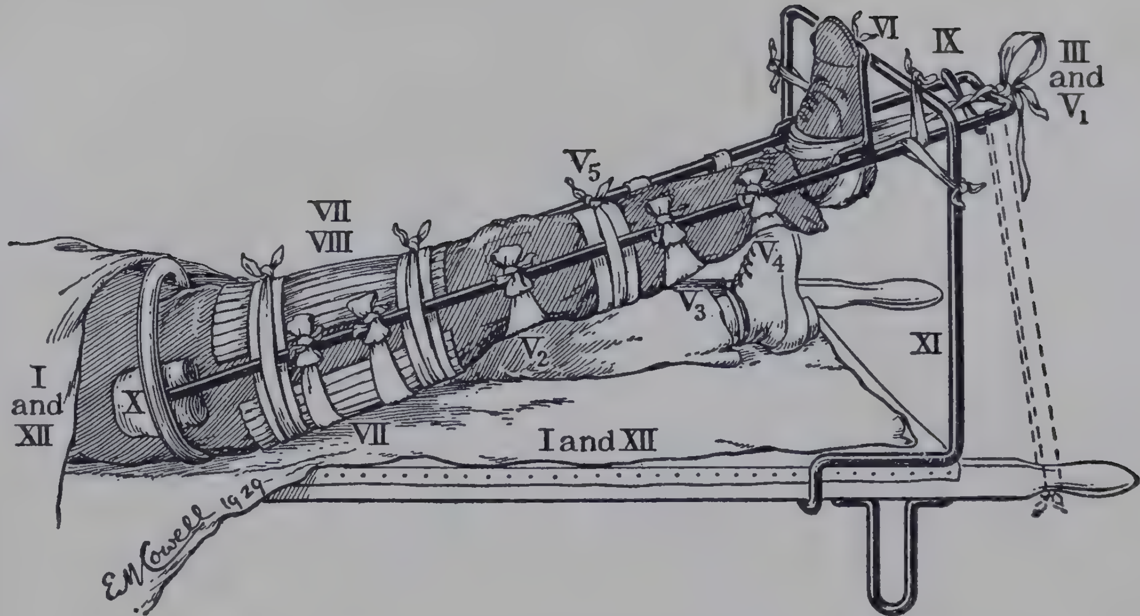


FIG. 170.—DIAGRAM OF THOMAS'S SPLINT, APPLIED AS FIRST AID MEASURE BY BRITISH RED CROSS SOCIETY'S METHOD

I and XII, Blankets; III, Y-shape clove-hitch halter at ankle, tied off in half-bow; V1, Extension bands tied off; V2, Sling behind knee; V3 and V4, Slings to support leg; V5, Narrow-fold, tied off in front to prevent leg rising out of splint; VI, Stirrup, to which foot is secured by figure-of-eight narrow fold (this is omitted for the sake of clearness); VII, Dressing; VIII, Gooch splinting supported by remaining slings and secured by narrow-fold bandages tied off in front; IX, Spanish windlass; X, Pad in ring; XI, Suspension bar, with lateral and suspension tapes. The dotted line shows position of the fifth narrow-fold bandage

lower end in a cross-bar about 4 inches long, which unites them and has a notch in its centre. The lower end of the splint projects about 6–10 inches beyond the foot of the patient, and as the ring at the upper end is set obliquely, the outer side-bar is longer than the inner. This splint can be used for either lower limb provided the longer side-bar is kept on the outer side; smaller sizes are made for children. Its object is to fix and support the whole length of the

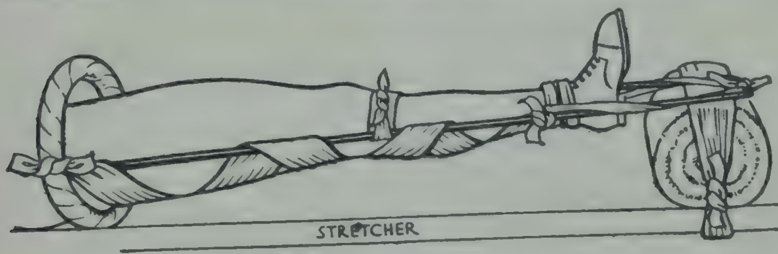


FIG. 171.—USE OF A THOMAS'S SPLINT WITH A STRETCHER

Thomas's splint applied. Note trough made of bandage, clove-hitch around ankle, with bandage carried round bars and tied at notch at end of splint. Bandage below knee prevents leg rising off splint. End of splint is resting on rolled-up rug; a bandage holds this in place. This, or an additional one, should hold the splint to the rolled rug and stretcher; it is not shown doing so in order to expose the extension bands

limb in an extended position, so that the broken bone or bones cannot be shifted or jolted when the casualty is moved. This is accomplished by passing the padded ring over the foot (the splint being held at first almost vertically) and up over the leg and thigh of the patient until it is wedged against the groin on the inner side and the buttock behind. The foot is then secured to the cross-bar at the far end of the splint, and the limb supported on slings fastened between the side bars. The whole apparatus is then slung from a horizontal bar fixed to the poles of a stretcher and called a 'suspension bar'. The limb is thus lifted a few inches off the surface. A special piece of equipment known as a 'stirrup' (foot-piece), which fits on to the side-bars, provides a support for the foot which may be tied to it (Figs. 170 and 171).

(iii) **Method of application:** In order to apply this splint efficiently, two at least and if possible three assistants are necessary. If it is a thigh-bone which is broken—

(*a*) One assistant supports and keeps up a firm and steady pull on the limb and foot, while another makes a clove-hitch knot in a 7-inch long flannel bandage; a third prepares slings with

triangular bandages passed round the inner side-bars and loosely tied round the outer side-bars to form a trough in which the limb will lie. Without relaxing the support and extension of the limb, the clove-hitch is slipped round the ankle, over the boot, so that both ends lie on the outer side, one being longer than the other. This longer end is now passed under the instep to the inner side of the ankle where it is threaded under the loop above, and then turned down along the inner side of the foot. The two ends will now be in position, one on each side of the ankle, and are known as 'extension bands'.

(*b*) With the slings tied loosely to the side-bars the splint is placed in position on the limb, as described above, by the third assistant, the second still supporting and keeping it extended. Both extension bands of the clove-hitch are tied round the notched bar at the end of the splint as follows:

(*c*) The outer band is passed over, then under the bar at the notch, tightened and held over to the opposite side. The inner band is passed in the reverse direction, that is, under, then over the notched bar, crossing the first band at the notch to prevent it from slipping. The two bands are then tied by a half bow, and the assistant supporting the limb and foot transfers his hold from them to support the lower end of the splint. While the above has been going on, the third assistant has been busy adjusting the slings on the side-bar to the required tension; having done this he ties the ends round the outer side-bar. One sling should be under the thigh, another under the knee (which should be slightly bent), a third under the calf, and a fourth under the ankle. To prevent the leg from being raised off the splint, the centre of a narrow-fold bandage is placed on the front of the limb, just below the knee, its ends passed down between the side-bars and the limb, crossed over one another on the back of the limb, then brought up over the side-bars and tied on the front of it.

Under certain conditions, such as when the bone is broken into several fragments, it may be necessary to provide further support by additional splints at the site of the fracture. Gooch's splinting is the most convenient type to use (carried by light mobile first aid units but not by rescue parties) and, if the time and circumstances permit, should be applied as follows. Two pieces of the splinting are placed on the thigh, one over and one under the site of the fracture, care being taken to see that

the lower edge of this upper splinting does not press upon the knee-cap; if there is a wound which has been dressed, they will be over the dressing. The centres of two narrow-fold bandages are placed on the upper piece of splinting, one above and one below the fracture. As in the previous bandage, their ends are passed down between the side-bars and the limb, crossed over one another on the lower piece of splinting, then brought up over the side bars and tied on the upper piece.

(*d*) The end of the splint should now be raised off the surface of the stretcher on which the patient is lying, and supported on a roll of blanket, or sandbags, placed across the stretcher, so that the entire limb is suspended between the ring of the splint under the buttock and the support at the other end of the splint. The foot must not touch this support. Extra padding is placed between the inner surface of the ring and the outer side of the thigh to act as a wedge and to prevent undue movement.

(*e*) If a stirrup (foot-piece) is used, it is sprung on to the side-bars and adjusted so that the shaped part fits against the sole of the foot, thus preventing any side movement. A narrow-fold bandage is then applied as a figure-of-eight to include the foot, ankle, and stirrup, by placing the centre of the bandage under the sole of the foot, bringing the ends forward, crossing them again, then bringing them up outside the side-bars and tying them off in front of the limb. This can also be carried out where no stirrup is used.

(*f*) If a suspension bar is used instead of a roll of blanket, it is fitted to the stretcher poles with its horizontal part a hand's breadth in front of the foot, and its grips away from the runners. The splint is slung about a hand's breadth below the horizontal part of the bar by bandages tied to the side-bars of the splint; to prevent any movement sideways, the ends of these bandages are tied round the upright portion of the suspension bar. To prevent movement of the splint in an upward direction (*e.g.* by jolting of the stretcher over rough ground) a narrow-fold bandage is passed round the outer side-bar and tied to the handle of the stretcher.

(*g*) Treatment for shock must be commenced as soon as the patient is found, and carried on during the application of the splint.

SYLLABUS OF INSTRUCTION (FOR FIRST AID COURSE)

This Course may be compressed into six lectures instead of nine, at the discretion of the Lecturer, if desired, but whichever plan is adopted the rule at paras. 14 (*a*) and 90 (*f*) (1), Form C, as to 75 per cent of attendances must be strictly complied with.

LECTURE I (Chapters I–II)

The Need for First Aid: Scope and aims; the approach to the problem; duties of the First-aider; 12 essentials to remember.

Circulatory System: The blood; circulation; the heart; blood-vessels; the general, pulmonary, and portal systems.

Practical. The triangular bandage; materials, size, how to fold; Used for (1) Slings; (2) To keep a dressing in place; (3) For a fracture when a splint cannot be used; (4) To pad a splint; (5) To hold a splint in place; (6) To cover a wound; (7) To arrest haemorrhage; (8) To make a ring-pad; (9) For fanning.

Slings. (1) Large arm-sling; (2) Small arm-sling; (3) Improvised slings; (4) Knots.

LECTURE II (Chapters III–IV)

Shock: Primary and secondary; signs and symptoms; treatment. Fainting or syncope; signs and symptoms; treatment. Electric shock; treatment. Insulin shock; signs and symptoms; treatment.

Bleeding or Haemorrhage: Varieties; signs and symptoms, first aid treatment. Venous haemorrhage; first aid treatment. Arterial haemorrhage; first aid treatment.

Practical. The triangular bandage; to keep a dressing on: (1) Hand; (2) Elbow; (3) Shoulder; (4) Chest; (5) Abdomen; (6) Back.

LECTURE III (Chapters V–VI)

External Haemorrhage: Course of the main arteries; treatment of external haemorrhage; the main arterial pressure points.

Internal Haemorrhage: Bruise or contusion; nose bleeding or epistaxis; bleeding from: ear; tongue; tooth socket; brain or

cerebral haemorrhage; lungs (haemoptysis); stomach (haematemesis); bowel (piles); kidneys and bladder (haematuria).

Practical. Haemorrhage; methods of arrest; (1) Digital compression; (2) Pad and bandage; (3) Tourniquet; (4) Arteries and pressure points.

Roller bandages; (1) Upper limb; (2) Lower limb.

LECTURE IV (Chapters VII–X)

Respiratory System: Anatomy and physiology. Suffocation or asphyxia; choking; smothering; drowning; suffocation by gases; electric shock and lightning stroke; artificial respiration.

Medicaments: Dressings, appliances, bandages.

Triangular Bandages.

Roller Bandages.

Practical. Haemorrhage; methods of arrest in cases of bleeding from hand and foot.

Artificial respiration; Schafer's method; Eve's method.

LECTURE V (Chapters XI–XIV)

Sepsis: The Lymphatic System. Asepsis and antisepsis.

Wounds: Types of wounds; general treatment of wounds; special wounds.

Burns and Scalds: The skin; causes of burns; degrees and effects of burns; first aid treatment. Treatment of special types of burns; air-raid burns.

Practical. To keep a dressing on: (1) Hip; (2) Knee; (3) Foot; (4) Ankle; (5) Head; (6) Eye.

Other uses of triangular bandages.

LECTURE VI (Chapters XV–XVI)

The Skeleton.

Fractures in General: Causes of fractures; varieties; signs and symptoms; splints.

Special Fractures: Skull: lower jaw (mandible); collar-bone (clavicle); shoulder-blade (scapula); upper arm (humerus); forearm; hand; ribs; pelvis; thigh (femur); knee-cap (patella); lower leg; foot; spine.

Practical. Splinting of fractures; upper limb; (1) Humerus; (2) Elbow; (3) Forearm; (4) Wrist; (5) Hand.

LECTURE VII (Chapters XVII–XVIII)

Muscles and Tendons : Strains. **Joints :** Sprains, dislocations. **Ear, Eye, Nose :** Structure, functions, and injuries.

Practical. Splinting of fractures; lower limb; (1) Femur; (2) Patella; (3) Lower leg; (4) Ankle; (5) Foot.

LECTURE VIII (Chapters XIX–XX)

Brain Injuries : The nervous system; unconsciousness; first aid treatment of unconsciousness.

The Abdomen and Digestive System. Urinary System.

Practical. The treatment of wounds; burns; sprains, dislocations. Roller bandages; (1) Head; (2) The body.

LECTURE IX (Chapters XXI–XXIV)

Poisons : Classification; general treatment of poisoning; the commoner poisons.

Miscellaneous Emergencies.

Action at the Incident : Preparations for the doctor; preparing for the patient at home.

Civil Defence First Aid : Crushing; blast injury; abdominal injury.

Practical. General revision.

FIRST AID: SHORT COURSE

Syllabus for a Short Course in elementary first aid, may be given in four or more sessions, each session to consist of (1) a lecture period, followed by (2) a period of practical demonstration and work. A session should take approximately one hour.

LECTURE I

The Need for First Aid. Shock, signs and symptoms, treatment.

Practical. The triangular bandage; materials, size, how to fold; used for (1) Slings; (2) To keep a dressing in place; (3) For a fracture when a splint cannot be used; (4) To pad a splint; (5) To hold a splint in place; (6) To cover a wound; (7) To arrest haemorrhage; (8) To make a ring-pad; (9) For fanning.

Slings. (1) Large arm-sling; (2) Small arm-sling; (3) Improvised slings; (4) Knots.

LECTURE II

Circulation of the Blood (detail, *e.g.* names of smaller arteries not necessary): Haemorrhage; venous and arterial bleeding; pressure points; external and internal haemorrhage; tourniquets; wounds and their treatment.

Practical. **Haemorrhage**, methods of arrest; digital compression, pad and bandage, tourniquet, pressure points.

LECTURE III

Asphyxia (including asphyxia from smoke, dangerous gases, and drowning): Artificial respiration; burns and scalds, first aid treatment.

Practical. **Artificial Respiration**, Schafer's method; triangular bandage to keep dressings on various parts of the body.

LECTURE IV

The Skeleton: Fractures; causes, signs and symptoms, varieties, principles of first aid treatment; brain injuries; first aid treatment of unconsciousness.

Practical. The treatment of **Fractures.**

INDEX

THE END

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